PUBLIC WORKS

Oct. 1950

CITY, COUNTY AND STATE

New Data on Refuse Collection and Disposal

Planned Public Works: Water Supply

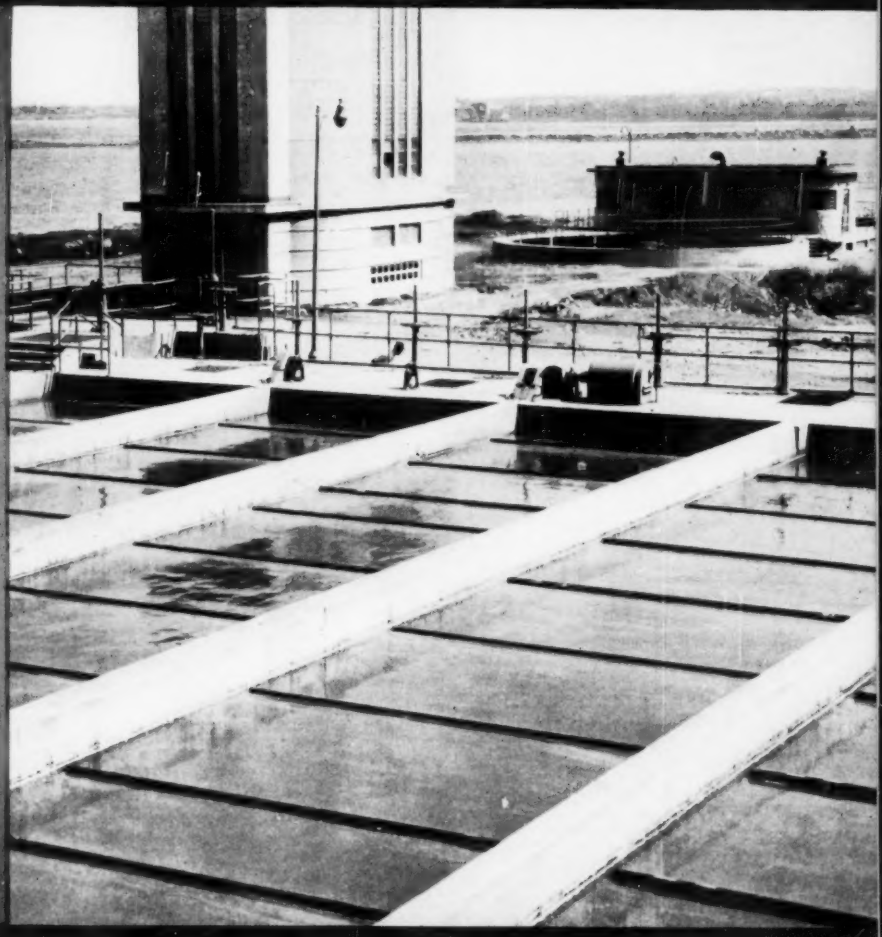
Winter Maintenance in Cleveland

Operation of Sewage Treatment Plants

Advance Planning Program For Public Works

How Cities Save Money With Equipment

Price of this issue 51.



MORE for your MONEY!

Weighs 6000 pounds with liquid in tires
Big 42½ H.P. engine
One-third the cost of a big grader
Hydraulic controls

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9 MAINTENANCE MACHINES IN 1

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2. HIGHWAY MOWER
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6. LIFT LOADER
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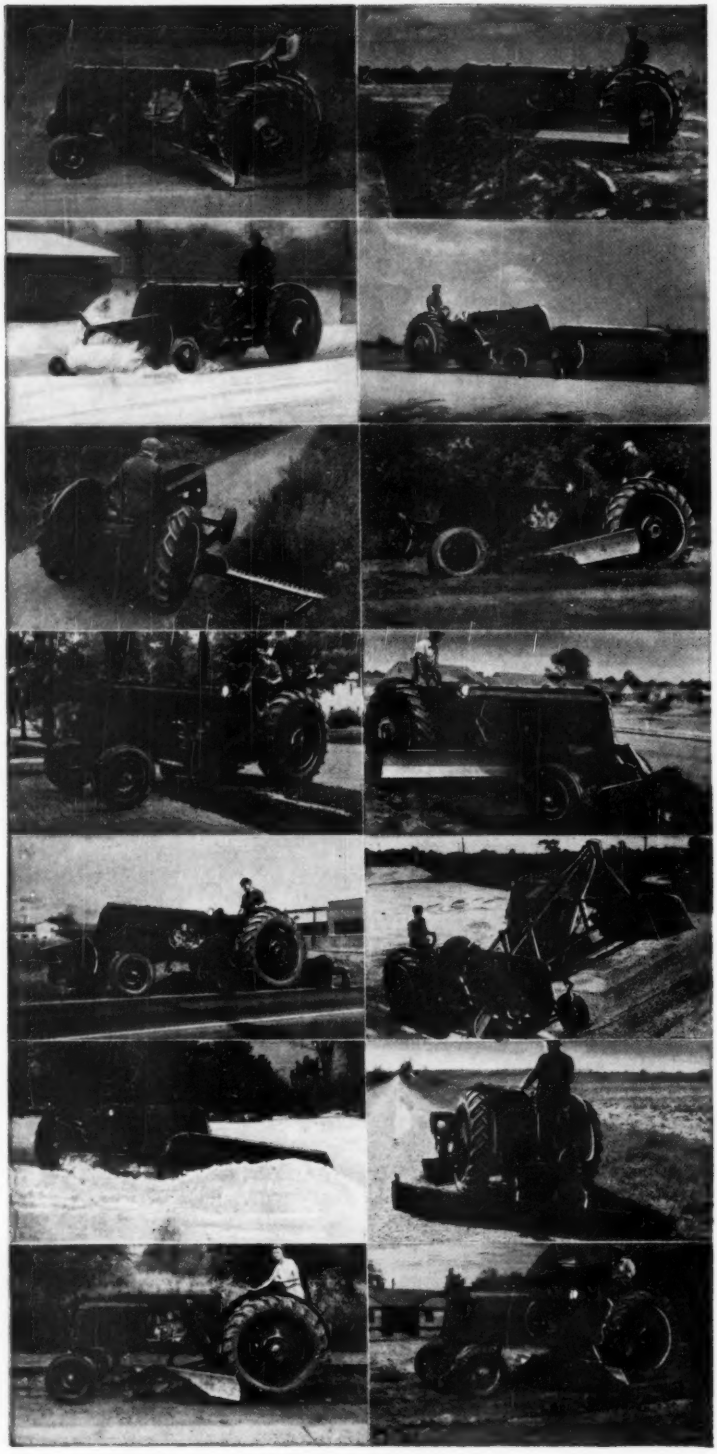
9. SNOW PLOW



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See your nearest HUBER Distributor for Maintainers, Rollers and other Road Machinery.

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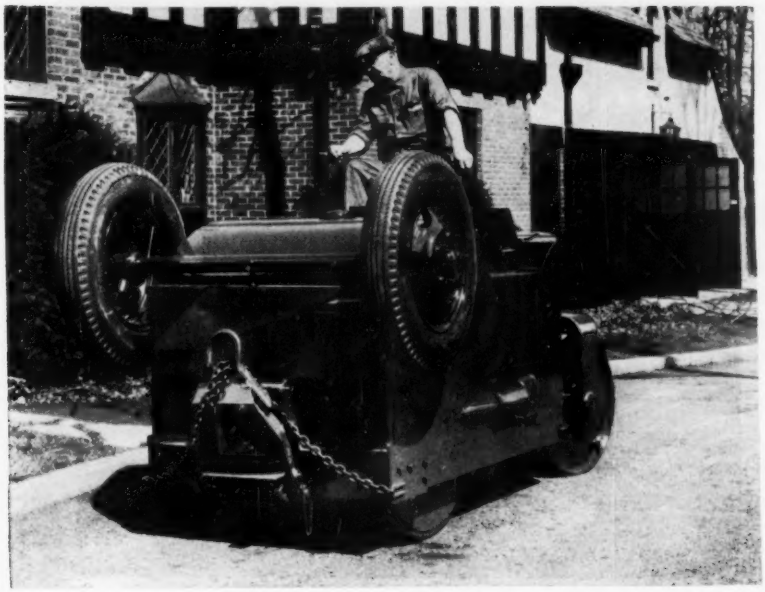

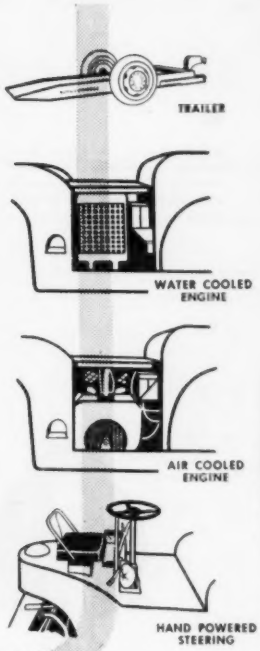

One Roller for 1000 Jobs!

That's a lot of work for a small roller—but Republic Asphalt Paving Company of Dayton, Ohio, completed exactly this volume of work during the 1949 season with their Buffalo-Springfield model KT-7, 3 to 5 ton tandem.

Used for patch work, driveways, parking lots and other small constructions, the KT-7 was quickly transported from job to job on its low-bed trailer. Now more portable than ever, when equipped with road wheels and husky towing attachment, the KT-7 can be completely rigged for hauling by one man in less than three minutes.

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If you have a variety of smaller rolling jobs in widely-scattered locations, you can cut lost time between jobs and save working time on the job with this rugged, economical and easily maintained heavy-duty roller. Your nearest distributor can furnish detailed information on either the Model KT-7 or the smaller 2½ to 3-ton Model KT-6. Call him today.

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THE STANDARD OF COMPARISON
SPRINGFIELD, OHIO

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Dept. G-6, Springfield, Ohio

☐ Please send me Catalog S-56-49 describing the right model for my requirements. ☐ Notify Distributor to call.

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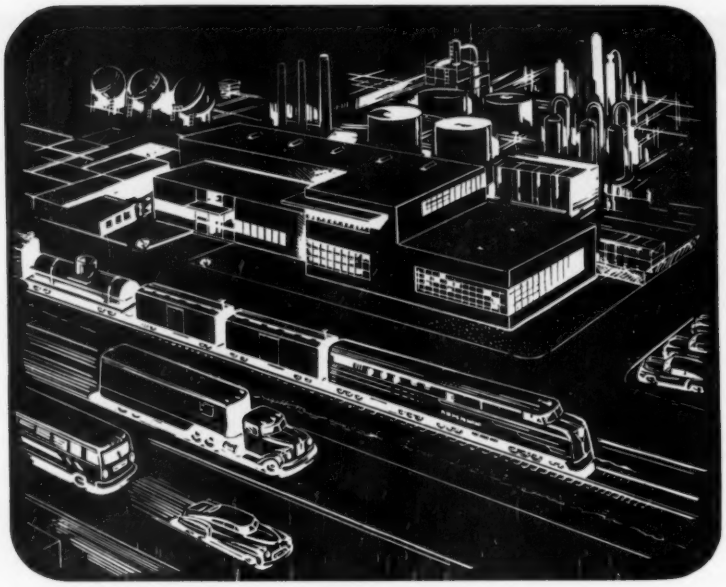
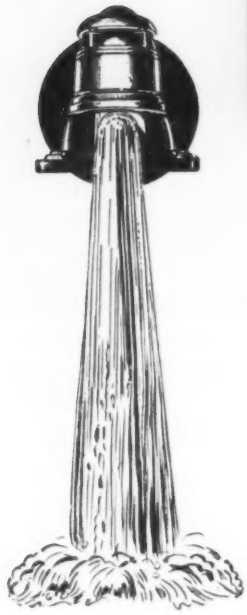
CITY ..... STATE .....



A new catalog on Layne Short Coupled Service Pumps with many diagrams showing applications, is now ready and will be sent upon request.



It Isn't A Question Of LEADERSHIP

Leadership in any field is a wonderful tribute to a fine product. But the Layne organization is anxious to have all prospective buyers consider the genuine quality of their Well Water Systems. Layne wants people to remember that their years and years of world-wide experience is being used to build better and better water systems; to find and remove even the smallest imperfection; to create, test and use new ideas that step up efficiency without adding cost.

Wherever you go, you will see Layne Well Water Systems serving cities, factories and all kinds of important industrial and chemical plants. In every case the buyer has carefully measured quality and efficiency against the investment and then decided that Layne and Layne alone could fulfill his needs.

A poor well is a bad investment. A good one saves many dollars each year. You can call in Layne and then contract for the complete job; survey, test drilling, drilling of the well, setting casing and sand screen, building and installing the pumps and final testing—all by well trained men of the Layne organization. No divided responsibility.

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LAYNE

WELL WATER SYSTEMS

VERTICAL *Turbine* PUMPS

When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

PUBLIC WORKS *Magazine*

Edited by W. A. Hardenbergh and A. Prescott Folwell

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310 East 45th St., New York 17, N.Y.

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CONTENTS

OCTOBER, 1950

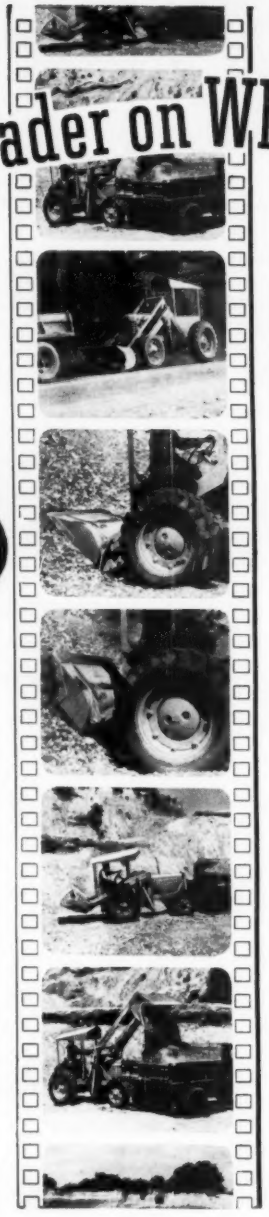
Now... the Most Versatile Loader on Wheels!

Here's the most versatile, practical loader ever developed for wheel tractors. It can dig in front . . . dump in front like the conventional loader. BUT, it can also dig in *back* and load in *front.*

You can dig in back . . . move straight forward to the truck . . . the bucket swings *straight over* the roof . . . and the load is dumped into the truck. Thus you eliminate the turning necessary with ordinary front end loaders . . . eliminate *half* the gear shifts and *half* the clutch wear. You save time and fuel . . . cut operator fatigue. You speed loader operations . . . *can load at better than a yard a minute.*

You get far greater traction and almost effortless steering with the Strait-Line. Rear-carried bucket load adds needed weight to the rear driving wheels . . . subtracts weight from the front steering wheels. Increased traction plus the new PUSH-TILT bucket with extended loading lips, enables you to get bigger bucket loads. Two levers control all operations.

Add them all up . . . ability to select your type of digging, front or back as the job requires . . . Strait-Line operation with back digging which gives you faster operation, greater traction and easy steering . . . fuller buckets . . . and you'll see where your operations can profit with the Strait-Line. For information and literature, see your Oliver Industrial Distributor or write direct to The OLIVER Corporation, 19300 Euclid Avenue, Cleveland 17, Ohio.



Conventional front digging, primarily used with Strait-Line where unit digs and moves straight ahead to load.

Back digging. Note how extended loading lips easily penetrate the bank.

PUSH-TILT action which lifts cutting edge 20" and thrusts it into bank.

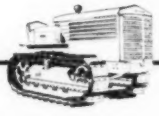
Carrying position—bucket is tilted to retain load and is carried low enough to increase both traction and stability.

Dumping position. Bucket has been carried over the roof and dumps in front.

THE OLIVER CORPORATION

A complete line of industrial wheel and crawler tractors

"FINEST IN INDUSTRIAL MACHINERY"



THE OLIVER CORPORATION

The Sign of Extra Service

When you need special information, consult READERS' SERVICE DEPT. on page 111-115.

THE EDITOR'S PAGE

Trucks and the Public Highways

PROBABLY all of us have, at one time or another, loudly or under the breath, cussed a truck that blocked our way; but a sounder and less emotional consideration of the matter makes us realize that trucks are the life-blood of today's business. Take the trucks off a city's streets, and that city would die—and quickly. Excessive restriction on truck usage will adversely affect business from the very minute that such restrictions are applied. From this statement, we except gross overloading of trucks. Some operators, probably only a relatively small percentage of them, threaten the welfare of the whole industry through excessive wheel loads for which many of our pavements were not designed.

As to taxes, and the question of whether or not trucks pay their way, much has been written, pro and con, and one can find in the literature proof of either view. We do not think that heavier burdens on trucks are necessary or even desirable. If gasoline tax money is not diverted to other purposes, there is plenty available to carry on our needed program of road construction and maintenance. The gasoline tax burden on automobiles used for business and pleasure is not excessive, and there are few complaints where these monies are not diverted. Higher taxes are not needed; but we do need to use this money for road purposes. Lowering of taxes on passenger cars and raising them on motor trucks would not solve this problem. We cannot afford to handicap the motor trucking industry; to do so would be the first step in throttling our own prosperity.

Civil Defense and Natural Disasters

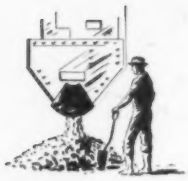
MANY cities are taking preliminary steps toward a civil defense organization. Unfortunately, not much national guidance has so far been available, so each city, with state advice in some cases, will have to do the best that it can. Money, of course, is not available except from local sources.

The particular type of organization that is best suited to local conditions must be worked out by local engineers and administrators. The work that will require engineering skills can be outlined a little better. For instance, in such matters as protection, determine the few places where sabotage would create really serious difficulty. A pipe line readily repairable in no more than a couple of days should not be included in this list, but a gate house might. Assume the important or key points are likely to be known to others; determine what it would take to damage seriously such points—a pound, a hundred pounds or a couple of tons of high explosive—and plan protection accordingly, whether by arranging for guards, or other facilities when necessary.

We still believe that the most important step in most of our communities is to determine those problems of repair, cleanup and sanitation which require professional skills, and to work out for each of these a team, a procedure and the necessary equipment and materials, even though no purchases are made. The team leaders can be selected from local engineers; a problem can be assumed, perhaps on the basis of experiences in World War II or in flood, earthquake or other disaster. From this, a procedure and the necessary tools can be worked out. Assume, for instance, an area without water supply and sewerage service: What steps will be necessary; what and how much materials and equipment must be available; what kind of personnel, and how much will be required—per block, per thousand population, or on any other basis? Having determined needs, what are the local resources in regard to them? If insufficient, can some be borrowed from neighboring communities? This is but one problem; there may be many others—cleanup of streets, repair of bridges, surveys for possible shelters (don't forget in these to include a census of toilet and drinking water facilities), traffic control, evacuation, housing, communications, and others.

We feel strongly that most cities have been lax in planning to meet natural disasters. These, we believe, are more likely to occur than any disaster due to action by a possible enemy. The broad principles of action are about the same in either case and preparation for one is preparation for both. On that basis, we urge that a start be made in determining possible problems, developing procedures to meet them, and working out an organization to carry out these procedures. Engineers ought to take the lead in this work, for they are better fitted by training and experience than is any other group.

When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

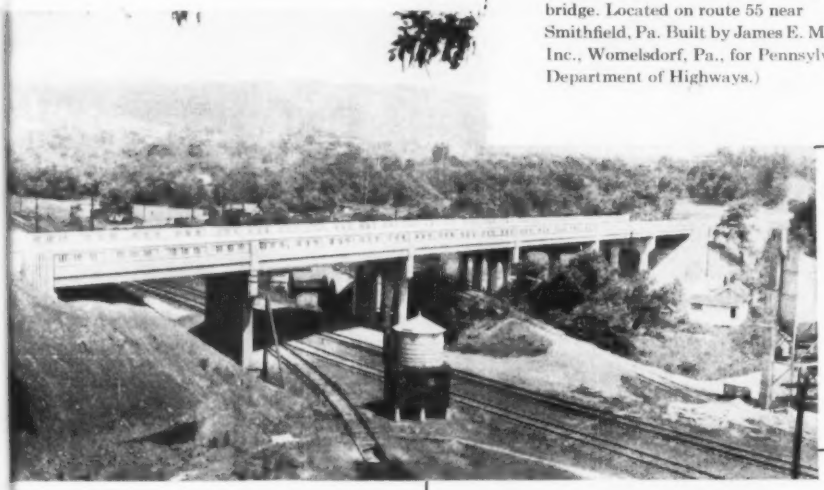


Better for heavy construction

Duraplastic air-entraining portland cement requires less mixing water for a given slump, makes concrete more plastic, more cohesive, more uniform. The increased plasticity aids proper placement, improves surface appearance of structural and mass concrete.

Makes more durable concrete

Duraplastic air-entrained concrete minimizes water-gain and segregation. Finished concrete is thus fortified against effects of freezing-thawing weather. (Below: Concrete I-beam continuous-span bridge. Located on route 55 near Smithfield, Pa. Built by James E. Minnich, Inc., Womelsdorf, Pa., for Pennsylvania Department of Highways.)



YET DURAPLASTIC* COSTS NO MORE

It sells at the same price as regular cement and requires no unusual changes in procedure. Complies with ASTM and Federal Specifications. For descriptive booklet, write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

OFFICES: *Albany, Birmingham, Boston, Chicago, Dayton, Kansas City, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, Waco.*

*"Duraplastic" is the registered trade mark of the air-entraining portland cement manufactured by Universal Atlas Cement Company.

PW-D-111

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Makes Better Concrete at No Extra Cost

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When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

A Dresser-coupled steel line delivers water cheaper...

In Jersey City, N. J., this 12,000-foot line, 48" in diameter, was speedily installed in a busy, built-up section. It tied in with two other steel mains laid in 1909 and 1918. Both of the older lines were found to be in excellent condition.

The cheapest way to deliver water to the place where it turns into revenue is with a Dresser-Coupled steel line—the line that

- **Cuts installation costs**
- **Cuts leakage losses**
- **Cuts maintenance costs**

Contractors like Dresser-Coupled steel lines because with lengths of steel pipe up to 50 feet, joints are fewer. They are *factory-made* joints, virtually foolproof. Dressers will take deflection up to 5° at each joint, eliminating the need for many costly specials. Consequently, schedules are easier to plan and easier to stick to and the job gets done faster. Crews are smaller and more easily supervised. The only tool needed to install Dressers is a wrench—no costly or hazardous equipment.

Waterworks officials like Dresser-Coupled lines because they get a better line at lower cost—a line with the bottle-tight dependability of flexible Dresser Couplings, the longevity of tough, shatterproof steel pipe, the sustained carrying capacity of modern glass-smooth linings.

From every angle—a Dresser-Coupled steel line delivers water cheaper. Ask your Dresser Sales Engineer for further information, or write today for literature.

BE SURE **you get the best line at the best price. Put steel pipe and Dresser Couplings in your specifications.**

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"FLEXIBLE-TIGHT"

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FRONT COVER . . .

The Bowery Bay installation is one of the largest in the country. Besides Sludge Collectors for the primary and final tanks, Jeffrey furnished Screenings Grinders, Grit Collectors and Grit Washers.

LETTERS

TO THE Editor

LOCATING SEWERS

Recently I read an article in an engineering magazine which had to do with a device for locating and tracing sanitary sewers. I have some work going on here where I have to locate old sewer lines and I will appreciate your assistance in locating this device.

Ralph W. DeLaney,
Consulting Engineer,
Ada, Oklahoma.

(Ed. Note: This appeared in our January, 1950, issue, page 50.)

FROM BRAZIL

I must tell you that PUBLIC WORKS has been a real help to me in designing small sewage treatment plants for hospitals. Perhaps I will send you an article about one of them which has been built near Rio. I would like to have any of your publications having to do with small sewage treatment plants and trickling filter design.

Also, I would like to know what opportunity there is for foreign engineers to get a fellowship or a job in the States. I had post-graduate work at Harvard, but other of our engineers are interested.

Homero Pedrosa,
72 Araujo Gondim St.,
Rio de Janeiro, Brazil

(Ed. Note: We hope that some of our universities and colleges will note the request for information regarding fellowships.)

"FOR YOUR INFO AND AMUSEMENT"

So writes a reserve officer of the Medical Service Corps in forwarding some material illustrating the fumblings of that Corps. He continues: "There has been an alarming lack of information in engineering publications and in letters to reservists outlining any proposed plan of the Medical Department for the sanitary engineering section of the MSC. The individual reservist, like myself, therefore, must assume that there is no organized plan for, or definite place in, the MSC for the sanitary

This Cleveland trenching machine, working on a water line in Hamilton, Ohio, is powered by a "Cat" D4400 Diesel Engine. The lugging ability and rugged power of "Cat" Diesels make them prime power units for this type of work.

"Never had a wrench on it!"

Underground Construction Company's ditcher, digging near Napa, Calif. This sewer system is a city project serving the state hospital, Napa and vicinity. Trench is 34 in. wide and 10½ ft. deep. Powered by the "Cat" D8800 Diesel Engine and working through red clay, the machine averages 600 ft. a day.

PERCY B. LAWS is operating engineer for the Underground Construction Company, digging 17 miles of mainline "outfall" sewer on the outskirts of Napa, Calif. He swears by — not at — the "Cat" Diesel D8800 powering his Parsons Trencher:

"This engine will pay for the whole digger in time," he says. "There's no limit to her power. Can't say too much about this D8800; it's absolutely perfect. We've never had a wrench on it, and it's amazing how little fuel it uses!"

Engineers like Mr. Laws, and operators and owners, favor "Cat" Diesel Engines because their performance is always way up to specifications. The rated horsepower is always there, plus reserve power to handle that unforeseen extra load.

"Cat" Diesel Engines are rugged. Their over-specification quality steels and precision machining enable them to take it day after day and job after job. They have the ability to lug, handling extra-stress loads smoothly and without strain or fuss.

And when you buy-in on famous world-wide "Caterpillar" dealer service, you get the parts inventory and factory-trained servicemen to keep 'em snorting on location. Why not ask your "Caterpillar" dealer to show you his parts and service facilities today?

LOOK UNDER THE HIDE

Filters are the watchmen of an engine's lubricating oil system. That's why "Caterpillar" filter elements are engineered and manufactured to extremely strict standards. They remove harmful particles as small as 39-millionths of an inch ... remove sludge ... have large filtering area and high flow rate ... do not remove beneficial additives ... are vibration-proof and waterproof. Look under the hide for quality — you'll find it in every "Caterpillar" detail.

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engineer. In view of these conditions, I would not recommend a sanitary or public health engineer to seek a reserve commission in the MSC, unless such action was necessary to obtain draft deferment."

(Ed. Note: This letter is typical of many except that it is written with some tolerance and without the use of language that inhibits publication. Of course, no information has been available. The reason is simple — nothing has been done; and it does not appear that there is enough leadership in either MSC or MC to do anything.)

SURE THING

Please send us ten copies of the article "Designing Pavements to Resist Bus Starting and Stopping" published on page 47 of the August, 1950 issue of PUBLIC WORKS.

Joe T. Lee,
Vice President,
Texas Bitulithic Co.,
Dallas, Texas.

BOOKS IN BRIEF

INDUSTRIAL WASTE

This is a compilation, 84 pages, same size as this magazine, and in smaller type, of articles by engineers and consultants. Most of the articles are by chemical engineers; a few by sanitary engineers. They illustrate how some plants have solved their waste disposal problems. Price $3. Franklyn Roberts, 3288 W. Boston Blvd., Detroit 6, Mich.

MUNICIPAL AUDITORIUMS

A 76-page book with a great deal of information on size, facilities to be included, grouping of facilities, location of the building, and many other factors, such as cost and operation data. $2.50. Public Administration Service, 1313 East 60th St., Chicago, Ill. By Farrell G. H. Symons.

CONCRETE INDEX

A 20-year index has been issued by American Concrete Institute, indexing and synopsizing Institute papers, 1929-1949. There are three main sections—subjects, authors and titles; sources of equipment, materials and services; and synopses of papers and reports. For information, write American Concrete Institute, 18,263 W. McNichols Road, Detroit 19, Mich.

PUT THIS SHEETING DOWN FOR ECONOMY

Sheeting that can be used only a few times is expensive for shoring trenches and other temporary jobs. You eliminate this costly practice with Armco Steel Sheeting because you use it again and again. Since the sections pull easily without damage they remain almost as good as new. You save the cost of new sheeting on succeeding jobs.

Between jobs you have no costly storage problem. The units are designed to nest together conveniently in a small area. Lightweight reduces handling and transportation costs.

There are still other savings on both temporary and permanent installations. Armco Sheeting has a small displacement area for fast driving. Corrugated design gives it ample strength without excess bulk. Lengths up to 20 feet and longer often can be driven to full penetration before excavating. You save time, and labor costs are low.

Armco Steel Sheeting is the economical choice for shoring trenches, constructing core walls, cofferdams, bulkheads and similar uses. Both interlocking and flange types are available. Write for complete information. Armco Drainage and Metal Products, Inc., 5240 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation.

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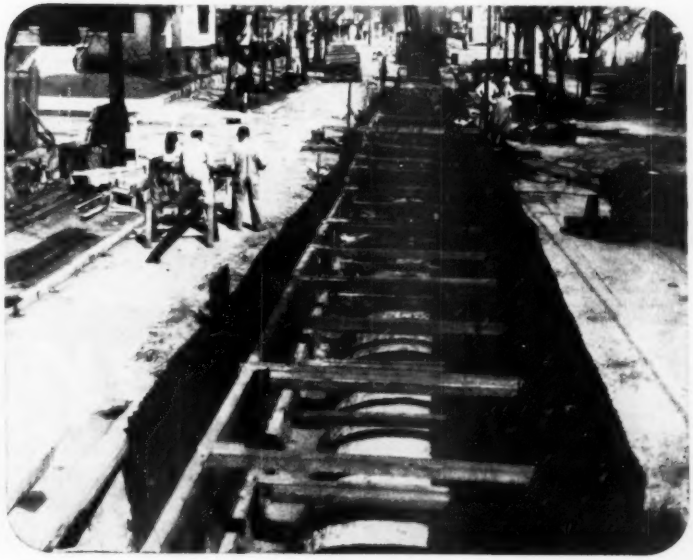
ARMCO STEEL SHEETING

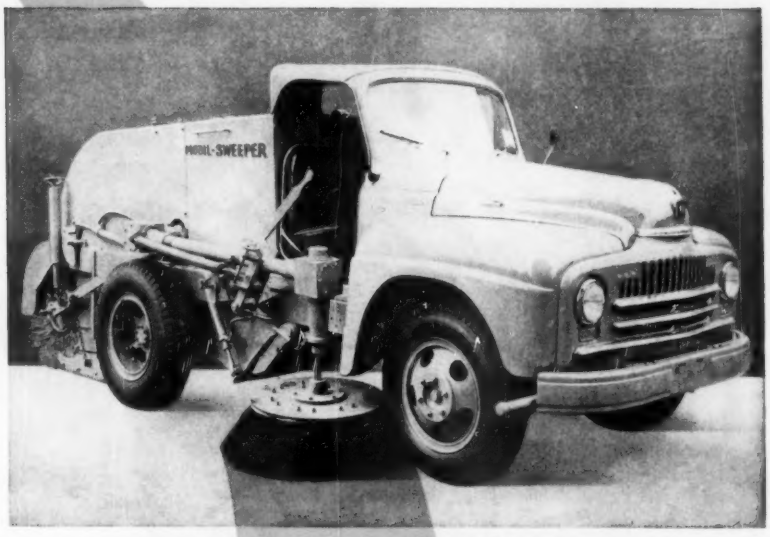
ARMCO



When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

MOBIL-SWEEPER

Sweeping the nation!



Mobil-Sweeper is literally sweeping the nation—cleaning the streets of cities from Los Angeles to New York in a nationwide sweeping tour that will wind up at the Public Works Congress in New York. The rugged, long-lasting features of Mobil-Sweeper make this severe sweeping test possible.

City, state and county officials are seeing first hand why Mobil-Sweeper is the best buy in street sweepers. Such economy features as—the big dirt hopper which loads and carries 2⅔ cu. yds. of refuse... the large water tank (200 gallons) that requires fewer stops for refills... and the time saved when dead-heading between service yard and sweeping area or to and from the dump, are important. Mobil-Sweeper travels up to 55 m.p.h. when not sweeping, which saves hours out of every week.

During winter months Mobil-Sweeper mounts a snow plow and works with dump trucks on snow clearance. This, plus unexcelled sweeping saves money for any city, county or state the year 'round. Write for details on

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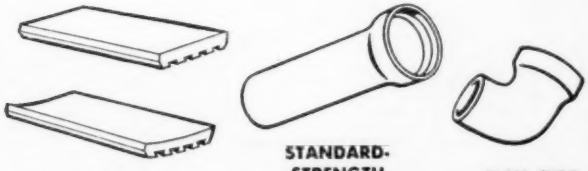

LINER PLATES | **STANDARD-STRENGTH CLAY PIPE** | **CLAY PIPE FITTINGS**

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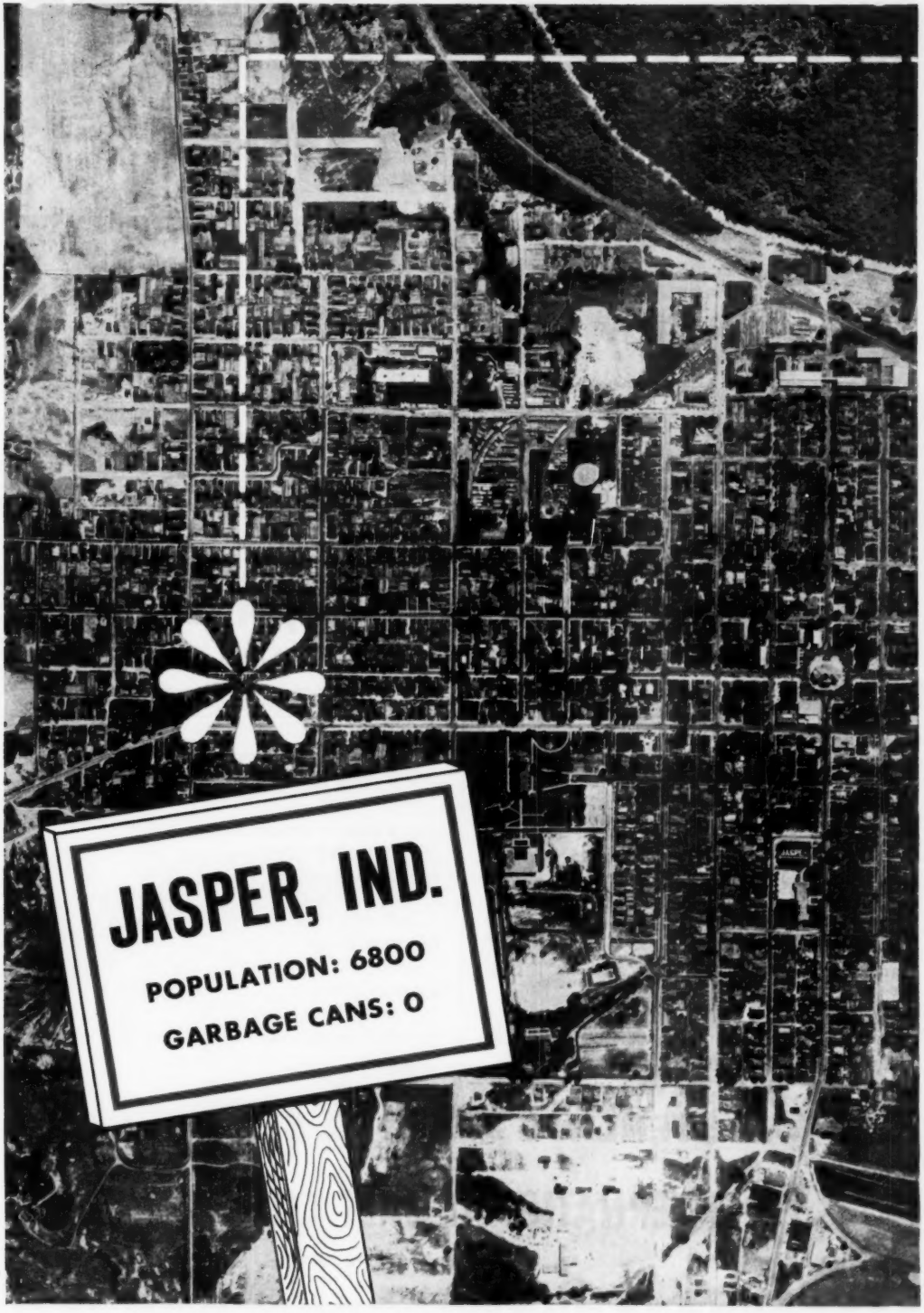
JASPER, IND.
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GARBAGE CANS: 0

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In Dearborn, Michigan they've made it the LAW!

City officials of Dearborn have earned the thanks of their community by taking the lead in abolishing the garbage nuisance!

IN MORE and more cities, rats and flies are being starved out of existence . . . garbage collection costs and problems are being stunted . . . the stage is being set for healthier, more pleasant city living.

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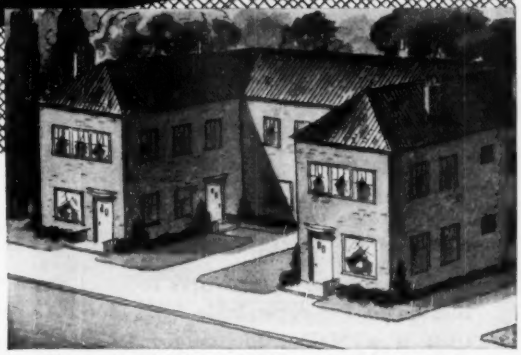
Because alert city officials are giving the same attention to the modernization of garbage disposal that has been given to plumbing and sewage facilities in the past.

Because officials are making the use of automatic food waste disposers LAW—and are earning the thanks and respect of their communities for doing it.



The people of Dearborn, who shop, eat, and live in this fourth largest Michigan city, will be healthier and happier—because *alert city officials made it a LAW* that existing multiple dwellings (over four families), restaurants, hotels, and markets be equipped with food waste disposers within a year . . . and all new buildings of this nature must be so equipped. It's the LAW!

FROM YOUR OWN VIEWPOINT AND THE VIEWPOINT OF THE PUBLIC, CONSIDER THESE POINTS OF SUPERIORITY THAT MAKE THE YOUNGSTOWN KITCHENS FOOD WASTE DISPOSER *3 WAYS BEST*:

1. **Food waste can be fed in continuously. No waiting for a load to be shredded and flushed with the Youngstown Disposer.**
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3257 Schaefer Rd., Dearborn, Mich.
Send me without charge or obligation, detail specifications on Ford Trucks for 1950.

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performance never equalled

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REFUSE COLLECTION UNIT

The Load-Packer was the original completely enclosed refuse collection unit with compressing action. From the start it has been the leader in the field.

Continuous improvement over the years has maintained this leadership. The Load-Packer is far out in front. Its performance has never been equalled.

The Load-Packer has an exceptionally low center of gravity—twin cylinder underbody hydraulic hoist . . . independently powered hydraulic tailgate unit . . . a surplus of hydraulic power for compression. Only Gar Wood builds the Load-Packer. See how it will reduce your collection costs and improve sanitation. Write for new bulletin.

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GAR WOOD INDUSTRIES, INC.
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PRODUCTS—HOISTS • DUMP BODIES • WINCHES • CRANES
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Please send me Bulletin M-60 telling how Gar Wood Load-Packers will help me reduce refuse collection costs and improve public health.

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Title_____

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City_____ State_____

Nashville Housing Authority Records Prove Economy of the Dempster-Dumpster System

A Message To All Cost Minded Municipalities, Housing Authorities—

"The Dempster-Dumpster System has fulfilled our requirements better than any other system of trash collection," the Nashville Housing Authority recently reported to the manufacturers, Dempster Brothers, Inc.

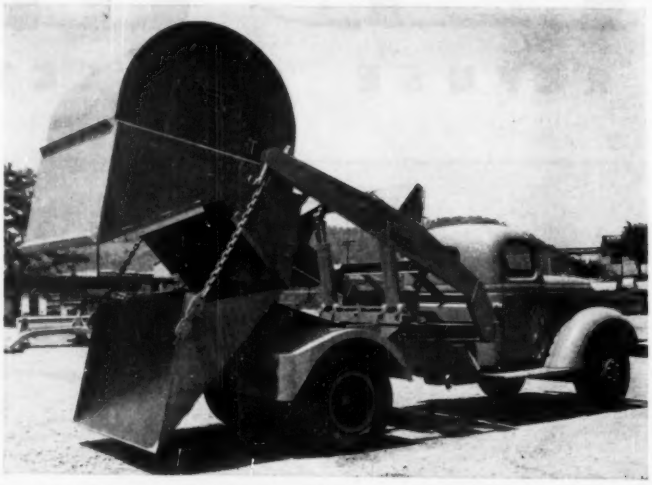
The Nashville Housing Authority is just one of the hundreds of users of the Dempster-Dumpster System who have cut their collection costs (oftentimes in half) and increased collection efficiency tremendously, after installing the Dempster-Dumpster System of bulk trash and rubbish collection.

Operated By One Man

The Dempster-Dumpster System is, simply stated, one or more truck-mounted Dempster-Dumpsters, with one man, the driver, to each unit, servicing any number of detachable Dempster-Dumpster containers ranging in size up to 12 cu. yds. The Dempster-Dumpster makes scheduled calls at housing, market and business areas, hospitals, schools, etc., and picks up a pre-loaded container, hauls it to disposal area where contents are dumped automatically, then returns container to replace another pre-loaded container.

This single truck-mounted Dempster-Dumpster services any number of containers, one after another. Each of the containers in the NHA's housing areas handle the refuse accumulated by 33 families, and are emptied twice a week by one of the City of Nashville's Dempster-Dumpsters.

The sanitation and cleanliness of the Dempster-Dumpster System are due to the completely closed steel containers. Trash and refuse cannot be scattered over streets and alleys by winds or scavengers in the fire-proof and rat-proof Dempster-Dumpster containers.



HERE'S A 10 CU. YD. APARTMENT TYPE container shown in dumping position. Its pay-load capacity is greater than the average conventional truck body. Container is placed in dumping position and drop-bottom section of container is lowered for dumping . . . all under complete control of driver in cab. This is the type container that handles the refuse accumulated by 33 families in a Nashville housing area.

System Grows as Needed

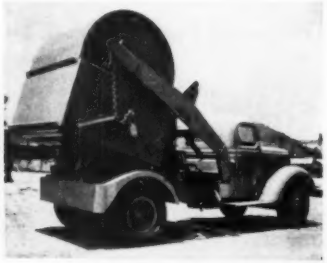
The City of Birmingham started out with 10 containers and one Dempster-Dumpster in 1938. Now Birmingham has 12 Dempster-Dumpsters servicing 204 containers. Richmond, Va. started out with 14 containers and two Dempster-Dumpsters in 1946. Today Richmond has six Dempster-Dumpsters servicing 288 containers. And so on down the line in city after city where the Dempster-Dumpster System is cleaning up business areas, school and housing areas—etc., and saving taxpayers thousands of dollars annually.

For example, when Richmond replaced the conventional open truck method of bulk rubbish collection in the business area with the Dempster-Dumpster System, it cut collection costs from $1.03 to .43 a cubic yard.

The pay-load capacity of the larger Dempster-Dumpster Containers is equal to or greater than conventional truck bodies. It is important to remember that containers are available in many different designs of every desired size. For instance, where it is desirable to have a water-tight container for moist or wet rubbish, a Tilt Type container is used. And, bear in mind, regardless of the design or size of the containers you have spotted at your congested business areas, schools, apartments, etc., one truck-mounted Dempster-Dumpster can service all containers.

The Dempster-Dumpster System triples man-hour efficiency . . . reduces truck investment, gas, oil, maintenance costs . . . improves "housekeeping" methods . . . reduces fire hazards . . . provides an easier, quicker, safer and more effective manner of handling trash and refuse.

If you have a bulk refuse handling problem, check up, by all means, on the Dempster-Dumpster System! Write today to Dempster Brothers, Inc. for complete information.



PICK-UP AND HAULING OPERATIONS are shown in the two photos above. Driver backs Dempster-Dumpster Unit up to loaded container, slips lifting chains onto lugs at each end of container, then, by hydraulic controls in the cab, lifts container into carrying position and drives to disposal area.

DEMPSTER DUMPSTER

TRADE MARK REG.

DEMPSTER BROTHERS

9100 Dempster Bldg.

Knoxville 17, Tennessee

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PUBLIC WORKS
Magazine
OCTOBER 1950 VOL. 81 • No. 10

Courtesy International Harvester Co.

REFUSE
Collection and Disposal in 927 cities

● ***THE sanitary fill method of refuse disposal has almost doubled in popularity during the last ten years.***

DATA on the amount, weight and, in some cases moisture content, of municipal refuse have been obtained from a number of cities through a questionnaire mailed during the first part of 1950 by PUBLIC WORKS. Returns have been received from about 1,400 cities. Data in this article are based on the first 927 returns; information from the other questionnaires (which are still being received) will be reported later. A somewhat similar survey was made by this magazine in 1940, and where the data are comparable, summaries of the information obtained at that time will be given so as to provide a picture of the changes that have taken place during these 10 years.

In the 1950 survey, 68 cities presented data on the amount of garbage or refuse, which data appeared to be of sufficient accuracy to be included in the tables herewith. Of these 68 cities, 32 reported separate collection of garbage, and the average amount of garbage reported by these 32 cities was 277 pounds per person per year. The collection of mixed garbage was reported by 11 cities. The average weight of this mixed garbage was 541 pounds per person per year. Also, 12 cities reported on "total collection." The average weight of the refuse collected by these 12 cities was 909 pounds per person per year.

Only 3 cities reported weight in pounds per person per day. These reports (1.5 lbs., 1.5 lbs. and 1.16 lbs.) were converted to an annual basis by multiplying by 310, the assumed number of collection days per year.

The average weight of the refuse reported in 1950 by the 68 cities, including 13 which did not state whether collection was "separate", "mixed", or "total", was 540 pounds per person per year. The 1940 survey asked for "weight of garbage" but there was no method of checking what was included in the term "garbage," and no doubt a number of cities reported total or mixed collections. In that survey, 18 cities reported an average of 1.55 pounds per person per day, and 42 other cities reported an average of 435 pounds per person per year. Data from the 1940 survey were published in the June, 1940, issue of PUBLIC WORKS.

It is interesting to note that a similar, but smaller, survey made by PUBLIC WORKS in 1927 showed an average of 314 pounds per person per year.

Table 1, herewith, lists the 68 cities alphabetically by states, according to general groupings of the amounts of waste reported. Information is given, when available, on collection practices.

Notes from the Survey

The city of Jasper, Ind., discontinued garbage collections on July 1. Home garbage grinders have been installed in sinks in all homes and apartments. It is believed that the reduced cost of collection, due to the elimination of the garbage, will soon pay for the installation of the grinders. Financing arrangements were made for easy purchase and installation of the units. Richmond, Ind., also noted that garbage collection would be discontinued after Sept. 1, when garbage will be disposed of into the sewers.

Clinton, Ia., carries on salvage operations which more than pay for

TABLE 1—AMOUNT OF REFUSE PER PERSON

City and State	Lbs. Per Person per Year	Collection Data
Over 1,000 lbs. /Person/Year		
Barberton, O.	1,800	.....
Corsicana, Tex.	1,500	Everything
Dallas, Tex.	1,100	Total
San Angelo, Tex.	1,000	Total
Richmond, Va.	1,050	Total
800 to 1,000 lbs. /Person/Year		
Winnetka, Ill.	866	Total
Louisville, Ky.	900	Tot.-Mixed
Wash. Sub. San., Md.	900	Tot.-Mixed
Great Falls, Mont.	962	Total-Sep.
Englewood, N. J.	840	Mixed
Garden City, N. Y.	860	Sep.
Knoxville, Tenn.	900	Combined
Wichita Falls, Tex.	894	Total
Seattle, Wash.	900	Total
600 to 800 lbs. /Person/Year		
Redland, Calif.	770	Sep.
Darien, Conn.	650	Mixed
Coral Gables, Fla.	614	Total
Duluth, Minn.	700	Total
E. Cleveland, O.	600	Total
Austin, Tex.	600	Total
Roanoke, Va.	700	Sep.
500 to 600 lbs. /Person/Year		
San Francisco, Calif.	595	Mixed
Lake Worth, Fla.	588	Mixed
Albany, Ga.	540	Total
Ft. Wayne, Ind.	590	Mixed
Summit, N. J.	556	.....
Tenafly, N. J.	510	Bumable
Cincinnati, O.	516	Combustible
E. Cleveland, O.	600	Total
Dayton, O.	513	Combustible
Bryan, Tex.	560	Total
400 to 500 lbs. /Person/Year		
Beverly Hills, Calif.	416	Wrapped
Long Beach, Calif.	465	.....
Lorain, O.	480	Mixed
Tulsa, Okla.	415	Mixed
Allentown, Pa.	429	.....
Ambridge, Pa.	500	Sep.
Under 400 lbs. /Person/Year		
Los Angeles, Calif.	207	Sep.
Pasadena, Calif.	334	Sep.
San Diego, Calif.	200	Sep.
San Leandro, Calif.	320	Mixed
Hartford, Conn.	170	Sep.
Greencastle, Ind.	365	Total
Clinton, Ia.	400	Sep.
Cambridge, Mass.	156	Sep.
Berkley, Mich.	155	Sep.
Dearborn, Mich.	230	Sep.
E. Lansing, Mich.	310	Sep.
Flint, Mich.	199	Sep.
Lansing, Mich.	257	Sep.
Pontiac, Mich.	292	Sep.
Wayne, Mich.	90	Sep.
Minneapolis, Minn.	185	Sep.
Kansas City, Mo.	250	Sep.
University City, Mo.	200	Sep.
Portsmouth, N. H.	270	Mixed
Hightstown, N. J.	350	Sep.
Princeton, N. J.	200	Sep.
Akron, O.	230	Sep.
Bexley, O.	360	Sep.
Columbus, O.	288	Sep.
E. Cleveland, O.	300	Bumable
Altoona, Pa.	43	.....
Jenkintown, Pa.	217	Sep.
Lower Merion, Pa.	400	Sep.
Philadelphia, Pa.	156	Garbage
Providence, R. I.	303	Combined
Warwick, R. I.	195	Sep.
Cudahy, Wisc.	164	Sep.
Kenosha, Wisc.	224	Sep.
Milwaukee, Wisc.	200	Sep.
Shorewood, Wisc.	125	Sep.

the salvaging costs. Newton, Kans., collects for refuse and garbage service by adding the charge on the water bills. The Washington Suburban Sanitary District, Maryland, bills semi-annually for refuse collection service on the water bills.

Lansing, Mich., grinds garbage and adds it to the digestion tanks at the sewage treatment plant. University City, Mo., computes the cost of collection service at about 6 cents per person per month. Philadelphia, Pa., and Rochester and Syracuse, N. Y., utilize reduction as a method of garbage disposal.

Weights Per Cubic Yard

The weight of garbage and refuse per cubic yard was reported by 62 cities and the overall average weight was 556 pounds per cubic yard. The figures varied from a high of 2,000 pounds to a low of 200 pounds. A separation by type of collections, whether separate or mixed, gives additional data on weight. The 31 cities reporting separate collections had an average weight of 765 pounds per cubic yard. The 21 cities reporting mixed or combined collections averaged 531 pounds per cubic yard.

The vehicle in which the refuse is collected has a marked influence on the weight. Many cities use the "packer" type of collection body and in such cases the weight per cubic yard will be greater. Summit, N. J., reports the weight "packed" at 450 pounds per cubic yard and "loose" at 250 pounds. Warwick, R. I., reports a "compressed" weight of 600 pounds per cubic yard and a "loose" weight of 380 pounds. The season of the year may also be a factor. Ft. Wayne, Ind., says the refuse during August, 1949, weighed 550 lbs. per cu. yd. and the moisture content was 45%.

Though 80 cities reported the weight per cubic yard of garbage in the 1940 survey, no average weight was given. Moisture content reported in 1950 averaged 58% as compared to an average of 55% reported in 1940.

Data on weight per cubic yard, the method of collection and, where available, the moisture content are shown in Table 2.

Collection and Disposal Methods

Of the 887 cities reporting on the method of disposal use, 10 discharge garbage into sewers; 110 utilize incineration for disposal; 189 use sanitary fills or landfill methods; in 282 the garbage is fed to hogs; and in 296 disposal is by open or infrequently covered dumps. A few cities reported using two or more methods of disposal, but generally only the major method was included in the tabulation.

Separate collection of garbage was reported by 570 cities and mixed collection by 205. There is some doubt if this question was fully understood by all who replied. However, the figures are not inconsistent with the methods of disposal reported and it may be assumed that the totals are not greatly in error. In many cities where private collection is in force, no method of disposal was reported and it may be assumed that feeding to hogs by the private collector was the final method of disposal. A number of cities did not reply to the question as to whether or not collections of garbage and refuse are separate.

In 444 cities, collection was by the municipality; in 246 by contract; and in 164 by private collectors. In 271, collection was from the curb; in 361 from the alley; and in 419 from the back door. The total of replies, 1,051, is greater than the number of questionnaires returned because a number of cities reported collection from two or even all three of the places. A considerable proportion of the cities reporting collection by private individuals, also reported back door collection.

Payment for Service

Payment for collection was reported to be "included in the taxes" by 444 cities; to be billed monthly or bi-monthly by 146; to be billed quarterly or at longer intervals by 55; and to be "collected by the collector" in 120; 20 cities stated there was "no charge" for collection. This is another question in which there have been some confusion in answering, for it is possi-

ble that the "no charge" group should be included in the "collected with taxes."

The replies on frequency of collection indicated a considerable difference between winter and summer service. A total of 102 cities reported 3 or more collections per week in the summer as compared to 62 having similar frequency of collection in the winter. Two collections a week in the summer were reported by 396 cities, as against 263 providing the same frequency of service in the winter. For once-a-week collections, the figures were 311 in the summer and 461 in the winter. A few cities omitted the winter answer and may provide no winter collection service.

TABLE 2—WEIGHT OF REFUSE

City and State	Weight lbs./c y.	Coll. Method	% Moist.
Over 1,000 lbs./cu. yd.			
Long Beach, Cal.	1,200	Sep.	60
Los Angeles, Cal.	1,003	Sep.	71
San Diego, Cal.	1,000	Sep.	. . .
Washington, D.C.	1,000	Sep.	65
Clinton, Ia.	1,500	Sep.	. .
Dearborn, Mich.	1,200	Sep.	. .
Columbus, O.	1,000	Sep.	80-85
Altoona, Pa.	2,000	Sep.	60
Ambridge, Pa.	1,350	Sep.	. .
Philadelphia, Pa.	1,000	. . .	75
York, Pa.	1,100	Sep.	. .
750 to 1,000 lbs./cu. yd.			
Hartford, Conn.	850	Sep.	. .
Des Moines, Ia.	800	Sep.	. .
Ann Arbor, Mich.	800	Sep.	. .
Dearborn, Mich.	900	Mixed	. .
E. Lansing, Mich.	800	Sep.	. .
Lorain, O.	800	Mixed	. .
Knoxville, Tenn.	900	Combined	. .
500 to 750 lbs./cu. yd.			
San Francisco, Cal.	700	. . . .	50
Darien, Conn.	700	Mixed	. .
Lake Worth, Fla.	600	Mixed	. .
Miami, Fla.	450-600	Mixed	52
Augusta, Ga.	600	Mixed	. .
Winnetka, Ill.	650	Mixed	. .
Ft. Wayne, Ind.	550	Mixed	45
Flint, Mich.	625	Sep.	. .
Wayne, Mich.	541	Sep.	20
Great Falls, Mont.	550	Sep.	20
Somerville, N. J.	700	Sep.	. .
Tenafly, N. J.	510	Mixed	. .
Binghamton, N.Y.	700	. . .	. .
Niagara Falls, N.Y.	500	Sep.	. .
Pleasantville, N.Y.	600	Sep.	. .
Bismarck, N. D.	500	Sep.	. .
Akron, O.	700	Sep.	. .
Tulsa, Okla.	600	Mixed	. .
Beaver Falls, Pa.	500	Sep.	. .
Warwick, R. I.	600	Compressed	. .
Danville, Va.	700	Combined	. .
Roanoke, Va.	700	Sep.	55
Milwaukee, Wisc.	500	. . . .	70-80
Less than 500 lbs./cu. yd.			
San Leandro, Cal.	320	Sep.	. .
Albany, Ga.	300	Mixed	. .
Anderson, Ind.	200	Sep.	. .
Alexandria, La.	450	Mixed	. .
Wash. San. Dist.	350	Mixed	. .
Summit, N.J.	250	Sep.(Loose)	. .
Summit, N. J.	450	Packed	. .
Yonkers, N. Y.	300	Sep.	30
Bedford, O.	340	. . . .	. .
Cincinnati, O.	340	Mixed	. .
Providence, R. I.	400	Combined	. .
Warwick, R. I.	380	Loose	. .
Dallas, Tex.	400	Sep.	. .
San Angelo, Tex.	352	Combined	. .
Wichita Falls, Tex.	275	Combined	. .
Newport News, Va.	400	. . . .	40
Richmond, Va.	350	Combined	. .
Seattle, Wash.	300	Combined	. .
Kenosha, Wisc.	317	Sep.	. .
Wausau, Wisc.	350	Sep.	. .
Shorewood, Wisc.	300	Sep.	85

1950 vs 1940

A similar survey was made by PUBLIC WORKS in 1940. In that survey, a differentiation was made between large and small cities. Returns included reports from 946 communities of less than 4,000 population and 1,316 places of more than 4,000. The 1950 survey covered some places of less than 4,000 population, and no differentiation has been made in compiling the returns.

Perhaps the most marked trend discovered by the 1950 survey is the tendency toward municipal collection. In 1940, 36.1% of the larger and 42.2% of the smaller places reported municipal collection; in 1950, municipal collection was reported by 52.0%. Collection by contract just about held its own with 23.8% in 1950 against 31.5% for the larger and 26.5% for the smaller in 1940.

TABLE 3—COLLECTION PRACTICES

Agency	*1950*	*1940*
Municipality	52.0%	36.1%
Contractor	28.8%	31.5%
Private	19.2%	32.4%

Private collection was reported by only 19.2% of the cities reporting in 1950, while the 1940 figures were 32.4% and 31.3% for large and small cities, respectively, in 1940. These data are shown in Table 3 for 1950 and for the larger communities surveyed in 1940.

Collections are less frequent in 1950 than they were in 1940. Whereas 9% of the larger and 14% of the smaller communities reported daily collection service in 1940, so few cities are now providing daily collections that no separate tabulation was made in the 1950 summary. In fact, only 2.5% reported four or more collections a week in the summer, and still fewer in the winter. Every-other-day collection service, reported by 17.0% of both groups in 1940, dropped to just under 10.0% in 1950. Twice-a-week service was reported by 49.0% in 1950 against 46.3% in 1940. Once-a-week collection increased to 38.5% in the present survey against 27.7% in 1940. These data are shown in Table 4. They appear to indicate that the rising costs of collecting garbage are affecting the service rendered. How important this is from the health and other viewpoints has not been precisely determined.

TABLE 4—SUMMER COLLECTION FREQUENCY

Frequency	*1950*	*1940*
Daily	2.5%	9.0%
3 per week	10.0%	17.0%
2 per week	49.0%	46.3%
1 per week	38.5%	27.7%

Note: 1950 "daily collections" include all collections of 4 times per week or more.

TABLE 5—PLACE OF COLLECTION

	1950	*1940*
Curb	26.3%	20.3%
Alley	34.2%	35.9%
Back Door	39.5%	43.8%

Winter collections show a strong trend toward once-a-week service, with 58.7% of the cities so reporting in 1950 against 49.2% in 1940. Twice-a-week winter service was reported by 33.3% as compared to 36.2% ten years ago. Only half as many cities give more frequent service now as compared to 1940.

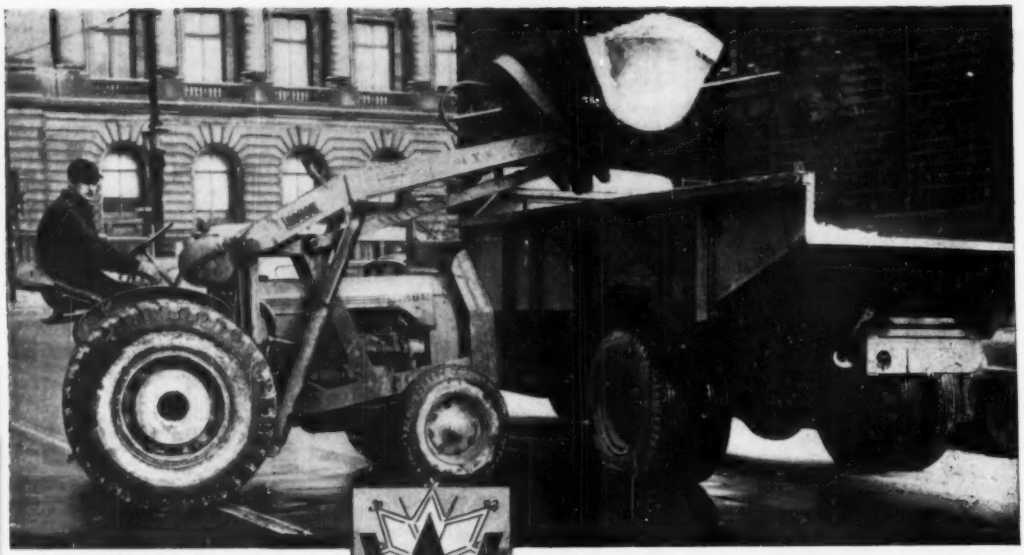
Another change which, like the decreased frequency of collections, may stem from financial considerations, is the increased frequency of curb collection. In 1950, 26.3% of the cities reporting collected from the curb, a practice reported by only 20.3% of the cities ten years ago. Alley collection was practiced by 34.2% in 1950 and 35.9% in 1940; back door collection percentages were 39.5 in 1950 and 43.8 in 1940. These data are shown in Table 5.

Methods of Disposal

Sanitary fills almost doubled in popularity, as might be expected due to the enthusiastic publicity given to this method of disposal. In 1950, 21.4% of the cities reporting operated sanitary fills, whereas in 1940 the percentage was 11.3.

Aside from the expected growth of the sanitary fill method of disposal, the principal feature of interest in comparing disposal methods of 1950 with those of 1940 is

(Continued on page 80)



● *LOADING snow near Cleveland's City Hall. Disposal will be made by dumping in Lake Erie.*

WINTER

ALLEN E. HINTON
Executive Assistant to the Mayor

WHEN the first flakes of snow come drifting down from the sky, Cleveland's snow removal army, like a football team awaiting the kick-off whistle, takes its position ready for the command from Fred T. Vitovec, Assistant Commissioner of Streets, which will send this army and its equipment on their way to keep traffic rolling over Cleveland's 1,200 miles of paved streets.

How well this snow removal army has done its job is attested by the fact that tire chains on automobiles and trucks in this city of almost 1,000,000 people are a thing of the past.

When a change begins to appear in the weather, Mr. Vitovec is in constant touch with the weather bureau at Cleveland Municipal Airport. As snow or rain with dropping temperatures, which may turn it to ice on city streets, moves nearer, he begins marshalling his forces.

Timing is Important

By the time the storm reaches Cleveland, the stage is set for operation snow removal. Every piece of equipment is in place. Every man in the crew is in his designated position. All is in readiness for the attack which will clear the city's main arteries of ice or snow in the brief period of a half hour.

As with many other operations, timing is very important. If the snow storm hits late in the afternoon then the personnel and equipment are located in strategic downtown spots so that all traffic lanes on the main arteries leading away from the center of the city are given immediate attention—so that snow cleaning equipment always is ahead of traffic.

However, if the storm hits early in the morning, then the equipment and men are placed at the outer edges of the city so that all traffic lanes leading toward the downtown section are cleared with the equipment doing its work ahead of the rush hour traffic.

Immediately serviced are 22 primary routes throughout the city.

The city has 19 salt and cinder spreaders including four Good Roads, six Anthonys and nine Baughmans. These are always loaded ahead of time with salt and cinders. If they are not used for several days then they are unloaded, cleaned and reloaded so they will be in workable condition when required for operation. If they remain loaded and idle too long the salt and cinders pack up and the equipment does not operate properly.

If the snow is less than two inches in depth, the 19 spreaders, each manned by a driver and laborer, are used. In addition 20 dump trucks go into service. These are manned by a driver and a crew of two laborers who shovel the salt and cinders into the streets from the trucks.

Handling Snow

If the snow is more than two inches in depth the snow plows go into action. The city has 60 plows including four 8-20 White trucks, 20 Ford trucks and 36 Federal trucks. Each is manned by a driver and laborer.

In addition there are nine front end loaders or tractors with buckets on front. These are used to clear the snow in the downtown area. They pick up all the snow in this area and then go into the major neighborhood intersections which have the heaviest traffic. When the trucks are loaded the snow is dumped on Cleveland's lakefront.

In the past, the downtown trucks emptied their loads into sewer manholes until a few years ago one man lost his life when he fell into one of the manholes and was washed into Lake Erie a half mile away by the swiftly rushing water in the sewers.

It also was found that by emptying the snow into the manholes, traffic on some of the main arteries was blocked and slowed as the trucks dumped, so now the snow is hauled to the lakefront and traffic is unhindered by the snow cleaning operations.

Mr. Vitovec maintains three crews for complete snow removal service around the clock. Each shift includes 22 drivers, 45 laborers and one construction equipment operator.

The shifts operate from 1:00 P.M. to 9:30 P.M., 9:00 P.M. to 5:30 A.M. and from 5:00 A.M. to 1:30 P.M. In this way there is a half hour lap-over period so that men coming off the job can relate to the oncoming crew what remains to be done and where troubles have arisen.

In addition the overlapping shifts gives the opportunity of having double crews on hand so that if the storm is exceptionally severe, men from the outgoing shift can be held over to aid the next crew.

Street Surface Maintenance

The city maintains one major resurfacing crew to apply asphalt to streets. An engineer is the representative of Service Director Samuel David in the field. There also are three district foremen. The resurfacing crew has an asphalt construction foreman along with three construction equipment operators, two roller men to operate Buffalo-Springfield tandem rollers and an operator for the Barber-Greene paving machine. There also is an additional operator for the paver, whose duty it is to regulate the depth of the resurfacing. In addition there are two rakers, five tampers who tamp and straight-edge gutters and four laborers who sweep and clean the street, regulate traffic and erect and place barriers. Three watchmen are maintained.

This crew can take up to 500 tons per day from the city's asphalt plant in the Flats section of the downtown area. The plant was designed to produce 480 tons of asphalt daily but has been stepped up now so that it can produce approximately 600 tons daily.

Generally 11 to 14 trucks and drivers are used to haul the asphalt mix, with each truck averaging four or five trips per day. The truck requirements are influenced by the length of haul.

An additional hired truck moves up the fire wagon, cleans up and removes dirt cleaned from gutters. This truck is also used to keep the crew supplied with all materials necessary for the job.

The city uses two general asphalt repair and utility opening crews. Each crew has an asphalt construction foreman, an operator for a 10 ton Buffalo-Springfield tandem roller, two rakers, five tampers, four laborers and a compressor.

Two asphalt trucks are used to supply each crew with hot mix. If the crew is at work on a large street opening, a front end loader is used to load waste material on trucks to be hauled away.

This year a third general repair and utility opening crew will be added because of the large number of defective areas in our old pavements.

Along with the asphalt work, two gangs are used for preparatory work such as raising manholes, catch basins, water valves. Utility concerns generally raise their own structures but are aided by the city gangs. These gangs also make repairs to defective pavement base and construct the approaches into intersections which must be raised or lowered for drainage purposes.

Other Street Repair Work

There also are six brick block and concrete repair crews which go through the city repairing openings made by utility companies.

Two separate crews of 45 men each are used for maintenance and repairs on the city's 80 miles of dirt streets. Two Galion graders and a Rosco or Standard Steel distributor is used with each crew.

When the time arrives for street cleaning and cleaning of catch basins, the first snow removal crew is used for that work.

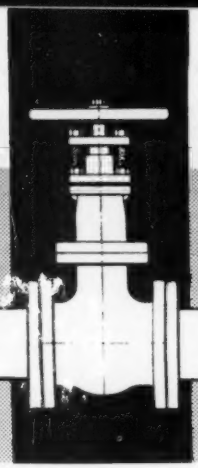
Operated along with the city's asphalt plant is a Barber-Greene cold patch plant capable of producing 100 tons daily for repair work. When the asphalt and cold patch plants are not operating during the winter time they are overhauled by their operating crews.

MAINTENANCE in Cleveland

● *AN organized program for spreading salt keeps traffic moving.*

PLANNED PUBLIC WORKS

WATER SUPPLY



R. R. McINTOSH

Director of Public Works, Battle Creek, Mich.

THE City of Battle Creek has an excellent water supply but during the depression and the war years that followed very little was accomplished towards keeping the pumping stations and distribution system fully efficient. As a result it was found that the demand exceeded the capacity of the plant and it was urgent that complete planning be started to modernize the entire system. The City had in operation two pumping stations and the combined capacity of the two was not equal to the peak pumping load. One of these, the Verona Pumping Station, derives its water supply from artesian wells in rock formation. The second, the Goguac Pumping Station, is supplied by gravel wells. The latter station was the original water pumping station for Battle Creek. The Verona Station is equipped with a 2,000,000-gallon underground reservoir. On the opposite side of town, at the Goguac Station, there is a 140,000-gallon standpipe.

Planning the Work

In 1917 the City employed the engineering firm of Jones, Henry and Schoonmaker of Toledo, Ohio, to make a comprehensive survey and report, with plans and recommendations, for the rehabilitation of the water pumping and distribution system. Upon the completion of these plans and recommendations, which included a new water pumping and treatment plant, the erection of a 3,800,000-gallon reservoir and two 200,000-gallon elevated storage tanks, and construction of approximately 55,000 feet of new pressure mains, the Engineering Division of the Department of Public Works reviewed them to determine the items which were of immediate necessity and should be considered first in the long range program.

At Goguac Lake it was decided that a recommendation to close the pumping station, erected in 1887, should be followed but that the replacement of the second pumping station at Verona and the construction of a water treatment plant could be postponed and that the city would proceed with the rehabilitation of the present plant at Verona and the installation of a 3,800,000-gallon reservoir and one of the 200,000-gallon elevated storage tanks proposed, together with 40,000 feet of the proposed pressure mains.

The closing of the Goguac pumping station made it necessary to provide a standby pumping service at the Verona Station since the old Goguac station was equipped with steam boilers and steam high lift pumps and had been used as a standby station for a number of years with a full crew of operators and firemen. The Verona pumping station was accordingly equipped with two gasoline driven American Marsh pumps of 3,000,000 gpd capacity each, together with a Redipower diesel engine generator capable of producing 70 KVA of 3-phase, 440-volt 60-cycle power to provide current for all the low lift pumping units serving the station. This arrangement assured the city of a minimum of 6,000,000 gallons per day standby protection. The creation of this new standby service permitted closing the old pumping station at Goguac Lake, reducing the staff by five men and the operating expense attached formerly required at this station.

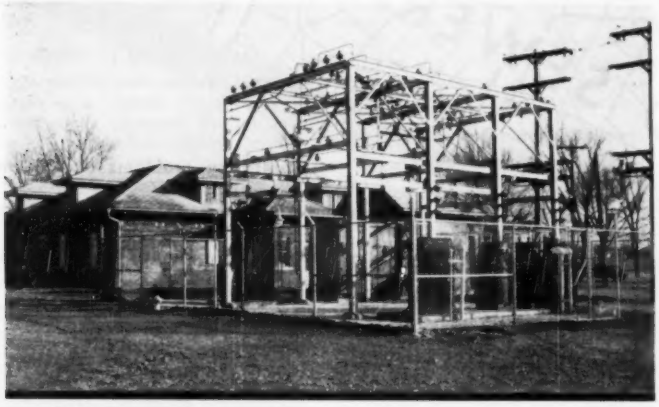
During 1948 the Public Works Department, in carrying out the proved the low lift water supply by letting a contract to the Layne-Northern Company for drilling five new wells of 1,200,000 gpd each at the Verona Station. This provided an increased low lift pumping capacity of 6 mgd, raising the total from 21 mgd to 27 mgd and protecting the peak maximum load of 25 mgd. The five wells are equipped with two Peerless and three Pomona Pumps, and connected to the 2,000,000-gallon capacity underground reservoir located at Verona Station. Also, three thirty-five-year old high lift pumps, two of which were of 3 mgd capacity each and one of 1½ mgd capacity, were replaced with new pumps of much higher efficiency. The completion of the above improvements at Verona Station in 1948 assured the city of an adequate water supply properly safeguarded by emergency standby service.

Contracts Are Let

In 1948 the Department of Public Works proceeded with the letting of a contract for the rehabilitation of the transformed sub-station at the Verona Station since an investigation had revealed that this subsome difficulty had already been caused by a failure in the middle of the 1947 pumping season when the demand was around 24 mgd.

Early in 1949 the Department also let contracts to the Chicago Bridge and Iron Company for the construction of the 3,800,000-gallon reservoir and 200,000-gallon elevated storage tank. These are located on the opposite side of the city from the Verona Pumping Station and are on the highest ground available. Construction was completed in May, 1950. An interesting side light in the construction of these two water storage facilities involved the study program determined on, also im-

of the ground structure on the land selected. Professor Housel of the University of Michigan was retained by the city as a consultant. From drillings taken by the Raymond Concrete Pile Company, under his direction, it was determined that the composition of the soil was of such excellent character, as far as bearing qualities were concerned, that it was possible to reduce the cost of the reinforced concrete supporting foundation by nearly $20,000. This shows the value of expert aid and assistance.



● ***REBUILT transformer substation at pumping station.***

In 1949 the City Commission realized that additional water revenues would be required to accomplish the first step of the long range improvements that have been outlined. As a result, it instituted a rate increase to bring in sufficient revenues to provide a basis for the issuance of revenue bonds. These new rates took effect on August 1, 1949. In order to provide ample coverage, the combined revenues of the water and sewer systems were pledged and on February 17, 1950 when bids were opened for the $1,150,000 bond issue it was found that the low bidder purchased these bonds at the very favorable rate, to the city, of 1.63%. This indicated that the bidder had a high regard for the present water system and the proposed improvements contemplated under the issue. Further support, of course, was given by the fact that the entire issue was approved by the Michigan Municipal Finance Commission.

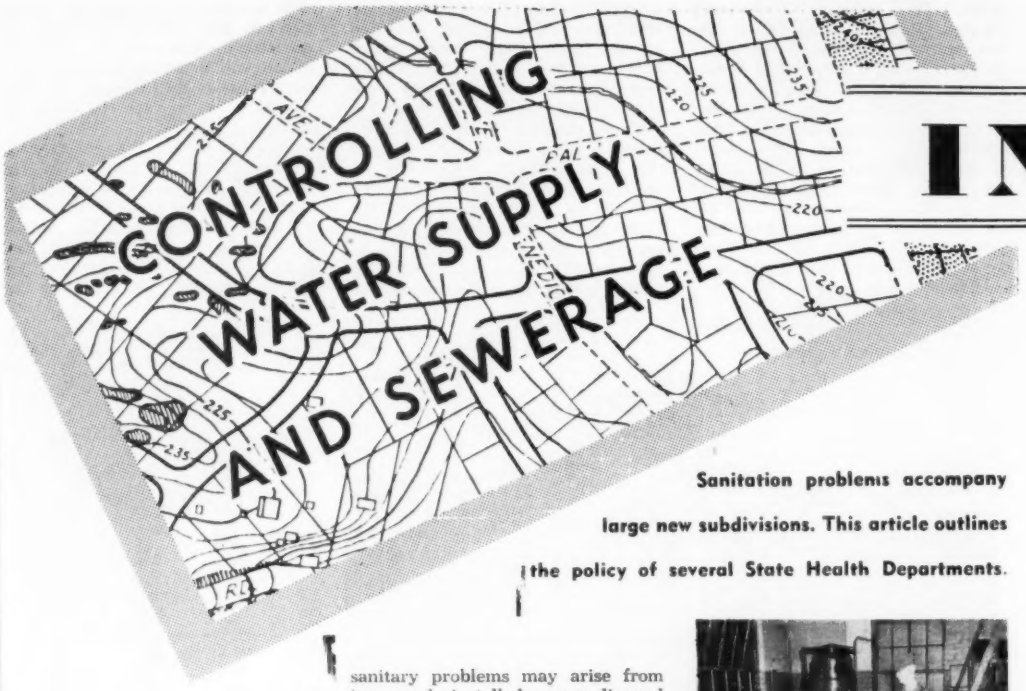
On February 24, 1950 the City let a contract to the P & M Construction Company of Battle Creek for laying approximately 29,000 feet of pressure mains to connect the Verona Pumping Station to the 3,800,000-gallon elevated reservoir and the 200,000-gallon elevated storage tank. These mains which will be of 30", 24", 20" and 16" cast iron pipe will be laid cross town splitting into a loop around the business section, to provide adequate pressure completely around this valuable part of the city. At the same time the city is now proceeding by force account to lay 11,000 feet of 12" main as a secondary protecting supply for the extreme northwest section of the city which heretofore has been served by only one 12" main. This will insure proper supply for fire protection.

● ***NEW elevated storage tank and booster station was completed in May, 1950, as part of the planned water supply program.***

During 1950 it is contemplated that some of the funds derived from the bond issue will be used for other projects. These will include a leak survey; the installation of meters to cover all public buildings and parks for the accounting of as large a percentage of water pumped as possible; the installation of thirty new and the replacement of twenty obsolete fire hydrants; and the cleaning of all mains in which it has been found there are accumulations causing a reduction in water flow. Further changes will include the reduction of the number of types of domestic meters in use from 17 to 3, which will immediately result in a saving as to the number of parts which it is required to carry in stock for repairs.

This concludes the relating of events which have taken place in the City of Battle Creek during the past two years brought about by advance planning in public works construction and rehabilitation. Experience indicates the results that can be obtained by coordinating the very best possible consulting advice with a determined effort to take advantage of it and to see that it is completed as planned.

As mentioned in a previous section of this series of articles, planning is still underway in Battle Creek and there are still many problems to be overcome. Principal items include the continued relief of our traffic situation and the grade separation of our railroads. It is expected when all the planning is completed it will probably be another ten or fifteen years before we will feel that we have completed all our major projects.



Sanitation problems accompany large new subdivisions. This article outlines the policy of several State Health Departments.

A report contributed by

GEORGE L. HALL

Chief Engineer,
Maryland Department of Health

IN Maryland, the State Board of Health has control over the installation of sanitary facilities for a subdivision where the developer plans to build houses on the project. When only lots are to be sold the developer is required to file a statement as to the methods proposed for water supply and sewerage services, and is urged to include in the sales contract that each lot purchaser shall install a well and provide sewage disposal facilities in accordance with the requirements of the local county health department. The State Board of Health may require the submission of comprehensive plans for water and sewerage systems for a development. It is hardly conceivable, however, that such sanitary systems would be constructed unless the developer proposes to erect a sufficient number of homes to warrant the cost of the systems.

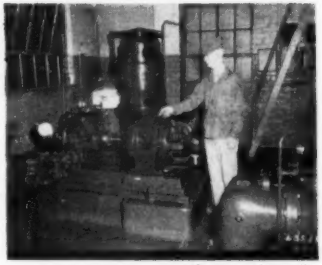
It is questionable under the law whether the State Department of Health can stop the sale of lots, even though it is realized that future sanitary problems may arise from improperly installed sewage disposal systems.

Developers of the larger subdivisions are encouraged to install a community water supply system for domestic use, since it can be shown that the total cost of such a system is less than that for individual wells for each property. Furthermore, the problem of disposing of sewage on each lot is simplified as adequate protection can be provided for a single well more readily than when each property has its own source of water supply.

Policy in Maryland

Any privately-owned community water supply system must be operated in accordance with the regulations of the Public Service Commission and all water rates are subject to review and approval by the Commission. Community - owned systems operated under a cooperative arrangement between the property owners, and not a profit-making venture, do not come under the control of the Commission.

Outside of the Health Department the only other control over subdivisions is by the local county health departments. These offices require construction permits for installing sanitary facilities for each building. This local control is now State-wide and is required by recent regulations adopted by the State Board of Health. Few of the counties in Maryland, however, have adequate building regulations relating to the erection of homes outside the incorporated municipalities. While permits for the erection of buildings are required by all boards of county commissioners, the major purpose of filing an application is to have the improvements to the property placed on the tax list. In those areas where the soil is totally unsuitable for the safe disposal of sewage, there does not appear to be any general effective legal procedure, at the present time, to prevent building a home.



Courtesy Caterpillar

● ***PUMPING station includes emergency power supply.***

Since the war, Maryland has had an unprecedented program of housing development, particularly in the rural areas where land is relatively cheap. Many of the sites are far be-

SUBDIVISIONS

yond the reach of sanitary facilities which cannot serve them for many years.

Policy in Other States

Information was received, in response to a circular letter on this subject from 39 states, Hawaii and Alaska. A problem relating to the installation of sanitary systems in new subdivisions was reported by 12 states, mainly on the East Coast.

In general, the replies indicate that there are no states having laws which would require the developer of a subdivision to install water supply and sewerage facilities for undeveloped lots. Most of the states emphasize the fact that successful control of water and sewerage facilities in new subdivisions can be obtained through a cooperative arrangement with the Federal Housing Administration and Veteran's Administration. A typical comment is that from Lee of Florida, who says: "In recent years, our strongest ally in controlling sanitation in fringe areas has been the Federal Housing Administration. All applicants for loans for houses involving private sewage disposal, or water supply, are required to secure our approval before the loans are granted. Since the majority of the houses constructed in Florida in recent years have been financed by the Federal Housing Administration and the Veteran's Administration, this method of control has proved to be exceedingly effective."

Specific Data From the Survey

The Arizona State Department of Health has an agreement with the State Real Estate Board by which the sale of lots in subdivisions will not be permitted until approval for water supply and sewerage has been given by the State Department of Health. The Regional Planning Commission of New Castle County, Delaware, has made it a policy that the State Board of Health must approve the water supply and sewerage facilities for any new development before the deed to the property is registered. In Davidson County, Tennessee, the County Health Department and the County Planning and Zoning Commission have a cooperative water supply and sewerage program for subdivisions. Soil absorption tests are made by County Health Department representatives and the lots must be of sufficient size to permit ground absorption of sewage effluent based upon these tests before a subdivision is approved by the Planning and Zoning Commission.

In Indiana, control of subdivisions remote from public water or sewerage systems is in the hands of local county plan commissions which may be established under the Planning Act of 1947. Maine exercises a considerable degree of control over these facilities under the State Plumbing Code. Enforcement is very effective in cities and towns having public water supplies and sewerage systems, but is faulty in rural areas.

In Massachusetts, provision is made for the submission of plans of systems of drainage or sewage disposal and water supply to the State Department of Public Health and no such system may be constructed without approval by that Department.

Michigan has waterworks and sewerage laws which give the Department of Health jurisdiction over any water supply or sewerage system serving the public, but private supplies receive no supervision.

Chicago, Ill., has jurisdiction over subdivisions for a distance of 1½ miles outside of the corporate limits, and Jackson, Miss., has authority to regulate subdivisions within a 3-mile limit beyond the corporate limits of the city.

In New York State the control over realty subdivisions is authorized by Section 89 of the Public Health Law. Regardless of whether the developer builds houses or sells lots he is required to show on the plans a typical lot layout or layouts. These plans must show the setback of the house and the location of the sewage disposal system. If a private well is used its location must be shown as well as the distance between it and the nearest portion of the sewage disposal system on the same or adjoining property. The details of the tile field, septic tank and seepage pit must also be shown on the plans, together with a cross-section of the soil and results of soil tests. If the developer is only selling

(*Continued on page* 108)

Courtesy Car Wood Industries

● ***TYPICAL subdivision where a new sewerage system must be installed to meet Health Department requirements.***

HOW CITIES SAVE MONEY

ON SEWER work in Alameda, Calif., R. A. Wheeler, Jr., Civil Engineer, a compressor with a pile driver attachment, pavement breakers and backfill tampers were used; on road repair work, the city used a motor patrol and scarifier, a bulldozer, oil spraying trailer, 9-ton roller and a 2-ton tandem; on street cleaning, 2 motor street sweepers, one leaf collector, a loader and four trucks were used.

Courtesy Caterpillar

● ***MOTOR grader speeds road work in Valley Stream, N. Y.***

Two tractor loaders, half-yard capacity, with specially designed buckets have speeded up refuse collection, by eliminating hand loading in Beverly Hills, Calif., according to H. J. Scott, Maintenance Superintendent. In building a stadium for Long Beach, Calif., James Kincaid, Director of Public Service, reports using 18-yd. carryall graders, bulldozers, and motor graders; the work involved 25,000 cu. yds. excavation and refilling with selected materials. San Jose, Calif., in its dead tree removal program, used power cranes and electric powered chain saws for removing dead trees from parking areas; H. J. Flannery is City Engineer.

Turlock, Calif., Richard H. Ward, Engrg. Ass't., reports that a 9-ton tilt-bed trailer, made in the city shop, has been most useful. This uses four 2600 airplane tires in line; each pair of wheels is on a rocker so all wheels carry the load even in the roughest terrain. Tree stumps are hauled by tilting the bed and shoving them on with a bulldozer. This unit is used constantly for all kinds of hauling. The city also designed a precast catch basin which will be shown elsewhere in Public Works. Glenwood Springs, Colo., J. L. Galloway, City Manager, reports use of a pulvimixer for mixing oil mats for roads and streets, preparing new cemetery ground for seeding and revitalizing gravel roads.

Golden, Colo., used a power shovel mounted on a truck for installing 2½ miles of 20-inch water main, and the same unit is also used for extensions to the distribution system. Henry Rolfes, Jr., is City Manager. In Grand Junction, Colo., snow removal during last January and February was especially pressing. Two motor graders were used to windrow the snow to the center of the street and a front end force feed loader was then used to handle it into trucks. On the airport runways, the two graders moved the snow to the sides of the paved areas; when a high pile was accumulated, a tractor equipped with a bulldozer was used to flatten it out. J. A. Burton is City Engineer.

A front end loader has been used by Wilmette, Ill., W. A. Wolff, Village Manager, for snow removal, loading sand and cinders for ice control, handling street sweepings and removing rubbish. Winnetka, Ill., R. L. Anderson, Village Engineer, used a sprayer mounted on a small wheel tractor for weed control, cutting the cost about 40%.

Home Garbage Grinders

Jasper, Ind., Carl J. Heim, City Engineer, writes that home garbage grinders are being installed on a city-wide basis in homes, restaurants, etc., to deliver the garbage to the new sewage treatment plant by way of the sewers. Garbage collections ceased on July 1. Carroll, Iowa, W. J. Youngerman, City Engineer, purchased an air compressor and tools for street work; this equipment has paid for itself in two years.

● ***ABOVE: City-owned distributor for bituminous maintenance.***

Iola, Kans., James L. Ross, Ass't. City Engineer, reports that a new oil distributor was used on sealing 71 blocks of streets, using 24,000 gals. of RC-3, at a total cost, including labor, of about 8 cents a sq. yd. W. E. Baldry, City Engineer of Topeka, Kans., reports using airplanes to spray along the river bank and for elm tree bag worms and brush control.

Two crane trucks were used by Cambridge, Mass., J. A. Tenney, City Manager, for laying sewer and water pipe, handling curbstones, towing trucks, loading and unloading machinery, pulling out tree stumps and taking out damaged sidewalks; they were also used for snow plows. Two tractor bulldozer units have been equipped by Lexington, Mass., J. A. DeFoe, Sup't. of Public Works, with cranes for lowering 36-inch pipe into the trench. Using these machines, 2,200 ft. were laid in 11 days. Walpole, Mass., F. F. Libby, Town Engineer, reports using a helicopter for spraying for elm beetles; this was a vast

Courtesy Allis-Chalmers

● ***MAJOR street repair calls for bulldozer operation.***

improvement over blowers. Winchester, Mass., J. D. Halwartz, Sup't. of Water & Sewers, has used a backhoe for all excavation work on lines, and a front end loader for backfilling and for loading trucks.

Front End Loader for Many Jobs

"Our front end loader is by far the most efficient, effective and versatile item of equipment we have.

WITH EQUIPMENT

Courtesy Austin-Western

● ***STREET sweeping is a constant maintenance problem.***

The types of jobs we use it on vary to such an extent that it is difficult to state which job utilized this equipment most effectively" says George E. Snyder, City Engineer, East Lansing, Mich. Grand Ledge, Mich., G. H. Krupp, Street Commissioner, uses a grader and a front end loader for excavating surplus dirt from streets, preparing a base for curb and gutter, blacktopping the street, and cleaning up. In Petoskey, Mich., E. L. Neumann, City Manager, a crawler tractor snow plow is used for plowing sidewalks; grades are so extreme that wheeled equipment could not operate efficiently. A street flusher was used to spread salt brine on 79 miles of streets by Port Huron, Mich., A. T. Carlisle, City Engineer. M. W. Harris, Sup't. of Public Works, Royal Oak, Mich., says the load packing type of refuse collection body was outstanding in efficiency; also a belt-type loader, which was used on street excavations, shoulder stripping and loading street dirt and leaves.

R. C. Fargo, City Engineer of Glasgow, Mont., says that the most effective pieces of equipment were a four-wheel drive motor grader and a ⅜-yd. truck mounted shovel and backhoe. An unusual job was done by Bemidji, Minn. M. J. Keranen, City Engineer, reports it as follows: "A beach cleaning job was done with a drag line and diesel tractor with bulldozer. The drag line dug a trench parallel to the shore. The bulldozer pushed bark and debris from the lake bottom into the trench; it then used the surplus sand to rebuild the lake bottom by bulldozing it back into the lake and letting the wave action smooth it. A 400-ft. section of beach was created in three days. Before the work was done, bark extended into the lake for a distance of 50 ft. from shore. This was successfully removed and buried; the volume amounted to about 1,000 cu. yds."

"In an extensive street improvement program last year, our tractor and front end loader proved very useful. We put in 31,000 ft. of curb and gutter; though this work was done by contract, there was plenty of work to do that was not in the contract. The front end loader was used to remove old culverts while installing storm sewers. We have a 2-yd. bucket on this loader for snow removal, so it is an all-year machine." R. H. Eikens, Superintendent, Caledonia, Minn.

Handling Heavy Snow

W. M. Somero, City Engineer of Ely, Minn., writes: "On snow removal, we used a motor grader and a truck plow to clear the streets, and a front end loader to handle the snow into trucks. This loader is mounted on a rubber tired tractor, and we use the same tractor for plowing sidewalks. The motor grader is used to break up snow and ice for loading. Most small communities lack sufficient specialized equipment, so we are forced to use what we have, and to the best advantage. We found that, with this equipment, we did a better job than we did in the past despite the heavy snows of the past winter. The public was well pleased. Except for extremely heavy falls, we did all plowing at night when we had least interference from traffic. Actual removal of the snow was done in the daytime, closing off one block at a time. We have designed a sand, cinder and chemical spreader which is simple and works very well. It does not require a motor or electrical connections and so is not affected by the chemicals we use in ice control."

A "dozer-loader" on a crawler tractor was used at the Red Wing, Minn., sanitary fill; also on ditching, working over outlying roads, snow loading in winter, and backfilling water and sewer trenches. James F. Enz is City Engineer of Red Wing.

Eliminating Frost Boils

A program of frost boil elimination was carried on by St. Peter, Minn., which is described by C. E. Dahlgren, City Engineer, as follows: "On a street which had shown heavy damage from frost boils, we used one shovel and four trucks to excavate slightly more than half the street width to a depth of 5 ft. at the centerline and 4 ft. at the curbs. When two-thirds of the one side was excavated, two trucks were assigned to haul gravel for a 2½-ft. lift, keeping the fill ahead of the shovel on the other side of the

Courtesy Barber-Greene Co.

● ***WINDROW snow is quickly loaded to clear this main street.***

street. The shovel made a 2-ft. cut, depositing this material on top of the 2½-ft. gravel layer. After one pass, a bulldozer was used to move the dirt over the gravel to permit a second shovel cut. Gravel was then placed on the other half and the material taken from the second half was leveled with a bulldozer. About 1 ft. of sandy loam was then spread over the roadway and a 6-in. layer of crushed gravel was spread for the final surface. Drain tile was laid along the center line of the

roadway to remove surplus water. Preliminary soil borings showed water saturation and excavation showed numerous springs. Results for the past winter showed no frost heave, whereas previously the heave had been as much as 2 ft. in preceding years. The compaction on this job was obtained mainly with a tractor bulldozer, the material being laid in about 4-inch lifts. So far there has been no settlement."

Gutters were cleaned in Columbus, Nebr., Bruce Gilmore, City Engineer, by using a special lip made to fit the snow bucket on a front end loader, mounted on a tractor. With this equipment, it was possible to remove mud from gutters that was too heavy to remove in any other way than by shovels.

In Milford, N. H., S. P. Grasso, Sup't. of Public Works, used a backhoe for ditching for sewer installation and a bulldozer for backfilling. Douglas MacNaughton, Sup't. of Public Works of Geneseo, N. Y., used a tractor loader for laying walks, handling and conveying the cement mix; and also for snow loading and handling tree stumps.

Lebanon, Mo., reports new equipment put in use during 1949, as follows: A tractor loader for ditch maintenance, snow removal and handling of materials; a new mechanical sweeper, permitting cleaner streets at lower cost; a new mechanical mower so that the city can do its own mowing work; and a new motor grader for better street maintenance. B. W. Johnson is City Manager.

Cleaning Culverts and Bridges

For cleaning out culverts and cleaning under bridges, Rensselaer, N. Y., A. G. Kaufman, City Engineer, uses a dragline operated by a truck with a winch attachment. Albemarle, N. C., George S. Moore, Sup't of Public Utilities, used an earth auger for digging holes for electric posts and also for water and sewer taps. S. E. Ake, Comr. of Sanitation, Bedford, Ohio, says: "Our front end loader was effective in moving material on the incinerator charging floor." In East Cleveland, Ohio, N. C. Kamuf, City Engineer, says that 1,800 catchbasins were cleaned in 2½ months with 3 men.

C. E. Brokaw, Sup't. of Highway Maintenance, Cincinnati, O., writes: "Our surface treatment program utilized mechanized equipment to the best advantage in treating more than a million sq. yds. of deteriorating pavement. This equipment included two gasoline rollers, one 5-yd. gravity feed spreader, one bituminous distributor, and an asphalt transfer and supply tank. The number of trucks used for delivering aggregate to the job varied considerably according to the distance from the supply yards. Sharing equal honors in mechanical equipment was our bituminous paver, which we used in rehabilitating 200,000 sq. yds. of pavement.

Digging Trenches and Laying Pipe

Altoona, Pa., Frank S. Varner, Sanitary Engineer, has used a quarter yard shovel for digging and a crane for pipe laying; also a patrol grader for grading work, with a bulldozer for cut and fill handling. A cinder and salt spreader was most useful to Bradford, Pa., J. Henry Quirk, City Engineer, on snow and ice control; a front end loader mounted on a wheel grader was used to load cinders into trucks and also to load snow at intersections and other places where the regular snow loader could not be conveniently used. D. D. Williams, City Engineer of Corry, Pa., reports using a power grader, 10-ton roller tractors and disc harrows in building tar stabilized streets. Walter E. Rosengarten, Township Engineer, Lower Merion Twp. Pa., used a front end loader for backfilling storm drain trenches, load excess dirt into trucks for disposal and level off areas along the job.

A trench hoe is used to excavate for water and sewer lines in Waynesboro, Pa., B. E. Smith, Borough Engineer, and a bulldozer for water line backfilling. P. P. Baker, City Engineer of Dyersburg, Tenn., writes: "We have just purchased two 9-yd. packer type of garbage trucks and are starting collections with them. In 1948, the city started doing its own street construction and we now have an air compressor, a front end loader on a rubber tired tractor, a distributor, a roller and a motor grader."

In Pampa, Texas, reports F. W. Brook, Engineer Assistant, the equipment that was most effective included a soil mixer, water distributors and sheepsfoot and pneumatic compaction apparatus. These were used in constructing soil stabilized streets, using a soil-cement base with a double asphalt surface

(*Continued on page* 106)

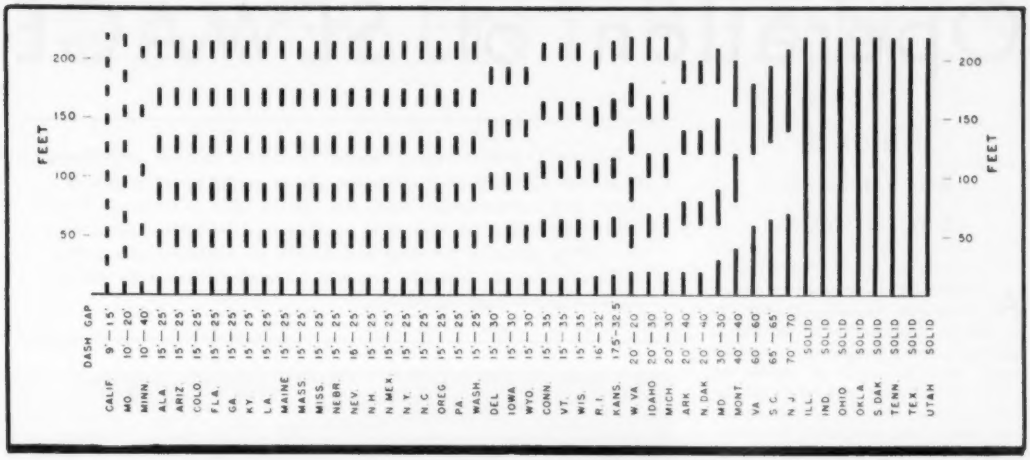
George S. Russell, president of Russell & Axon, consulting engineers, St. Louis, bears out notably our theory that a good engineer is also a first rate human being. Emerging in only two years from University of Illinois with a B.S. degree and two fraternity pins—Tau Beta Pi and Sigma Xi—he has since added many activities and honors. A year as vice president of the F.S.W.A. preceded two years as its president. His hobbies include his family, writing articles on sewage treatment, and being a perfect-attendance Rotarian.

George S. Russell

LEADERS

IN THE PUBLIC WORKS FIELD

MORE REPORTS ON EFFECTIVE USE OF EQUIPMENT WILL APPEAR SOON



● ***CHART showing practices of the states in pavement striping on state highways.***

DESIGN *for* *PAVEMENT STRIPING* on Two-Lane Roads

PAVEMENT striping practices of the State Highway Departments were surveyed by the Bureau of Public Roads for the Committee on Roadway Pavement Markings of the Highway Research Board. This survey shows wide variations in the design of center lines for 2-lane highways.

The 1948 Manual on Uniform Traffic Control Devices specifies that the center line on two-lane roads shall be a "broken" or "dashed" white line. No arbitrary length is prescribed for the line segments (dashes) or for the intervening gaps between segments, but 15 and 25 feet, respectively, are suggested as constituting a suitable pattern.

Eight States use an unbroken (solid) center line exclusively. The same number report the use of solid lines under certain specified circumstances, e.g., a solid black bituminous line on the center joint of concrete pavements, or a single solid white line through particularly hazardous sections, dashed lines being used elsewhere.

The 15-ft.—25-ft. pattern recommended in the Manual is much the commonest, being used by 19 out of the 40 States that report dashed lines. There is a wide range in design, however. California, with 9-foot dashes, and New Jersey, with 70-foot dashes, represent the extremes. South Carolina, with 65-foot dashes, is contemplating a change, presumably to a shorter length.

Objections have been made to excessively short dashes and gaps, on the ground that they cause an unpleasant and possibly dangerous "flicker" when seen from a vehicle in rapid motion. No adequate scientific data have been published, however, to establish critical dimensions in this respect. At the other end of the scale, it is pointed out that needlessly long gaps lower the effectiveness of the line as a guide, especially during darkness or unfavorable weather. But here also there are no conclusive research findings to tell how long a gap can or should be to avoid both these objections.

Since a major argument in favor of the dashed line is that it requires less paint than a solid one, the ratio between the lengths of dashes and gaps is at least as important as their absolute lengths. The lower this ratio, the greater the economy in point—subject to certain allowances for drippage and other losses. Apparently, however, there is a practical lower limit to this ratio. Although dashes as short as 9 feet are used, and gaps as long as 70 feet, these extremes are not used together. Short dashes are associated with relatively short gaps, long dashes with long gaps. In only one State, Minnesota, do the painted dashes cover as little as 20 percent of the over-all length of the line (ratio 1:4). In only six States, other than those that use a solid line exclusively, are the dashes as long as the gaps (ratio 1:1). All other States fall well within these limits. In 70 percent of the States that use a dashed line the dashes make up between 33.3 and 37.5 percent of the total length of line. The 15-ft.—25-ft. pattern accounts for all but one of the 20 States painting 37.5 percent of the line, the exception being California with a 9-ft.—15-ft. design.

Either the 17 different designs of stripe reported are all equally effective—which seems hardly likely—or there is need for experimental research to determine just what is the best pattern. The Committee on Roadway Pavement Markings will cooperate with any highway department or other competent agency in planning studies of the type desired.

Operation of SEWAGE

THIRD
REVISED
EDITION

Intended to provide helpful material for the training and qualification of sewage treatment plant operators, and to supply technical data in a simple and understandable form, this text was first published in 1938. Four years later it was revised to meet wartime conditions and to help in training operators for army and defense establishment plants. Now, in response to a continued demand, the material has been entirely rewritten and brought up to date.

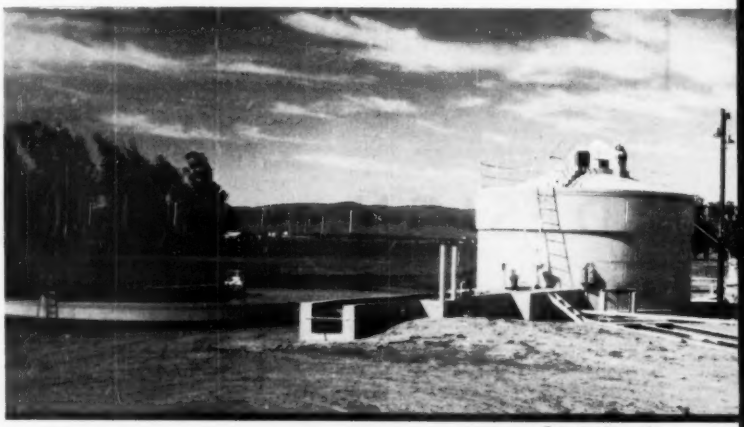
A SEWAGE treatment plant is designed, constructed and operated to protect the public health and to prevent nuisance. A treatment plant is costly to build and costly to maintain and operate. The best planning and the best materials and equipment should be incorporated into it. Likewise, it should be operated so as to provide the maximum return on the investment in it. The operator should be skilled in his work and he should be paid in accordance with that skill. This article is intended to provide the basic information and reference data for the operator, and to act as an introduction to modern textbooks and literature which consider those factors that enter into treatment plant operation.

It should not be necessary to state that a plant should be kept clean and attractive; that the area around it should be covered with good grass, kept mowed; that equipment should be maintained in clean and good operating condition; and that buildings and, where applicable, equipment should be kept freshly painted. Nor should it be necessary to state that the operator ought to have office space where he can keep his records; a laboratory where he can perform the necessary tests and examinations; and a suitable lavatory, shower, toilet and working clothes storage facilities.

The Various Methods of Measuring

In measuring flows of sewage, the U. S. gallon is used almost invariably. This is not the same as the Imperial gallon used in Canada and England. The Imperial gallon equals 1.21 U. S. gallons, and the U. S. gallon is 0.83 as large as the Imperial gallon.

Sewage flows are usually measured in millions of gallons per day, abbreviated mgd. For instance, 1,875,000 gallons per day is written 1.875 mgd; 250,000 gallons per day is 0.25 mgd. When considering pump discharge or pump capacity, gallons per minute (gpm) is frequently used. It is convenient to remember that 700 gpm is very nearly equal to 1.0 mgd.



Courtesy Dorr Co.

● ***MODERN sewage treatment plants are designed to make operation as easy as possible, but operators must be well trained and alert.***

Cubic feet per second (cfs) is used to measure flows in very large sewers, usually in those carrying storm water; and also the flow of streams. A flow of 1 cfs equals 0.646 mgd.

The metric system has no application in this country to the flow of sewage, but it is exceedingly handy in laboratory work. It is seldom necessary to convert the metric units to pounds, feet and gallons; when conversion is necessary, it can usually be best accomplished through the familiar parts per million (ppm). However, a brief outline of the metric system will be given.

The basic unit of volume in the metric system is the liter, which equals 1.05 U. S. quarts. There are 1,000 milliliters (ml) in a liter. Older texts refer to cubic centimeters (cc); for all practical purposes, these are the same as milliliters. The liter weighs 1,000 grams under standard conditions of water temperature and purity; and 1,000 grams equals a kilogram, which is about 2.2 pounds.

In laboratory work, the milligram (mg), which is one-thousandth of a gram, is the smallest weight normally used. The milligram is one-millionth of a kilogram, the weight of a liter of water. Therefore, one milligram in one liter is one part per million.

It is a little more complicated to get parts per million when using our U. S. terms. Since one gallon weighs 8.33 pounds, a million gallons weigh 8,330,000 pounds, and one part per million is 8.33 pounds per million gallons.

When using some chemicals, especially those used in water treatment, the term grains per gallon (gpg) is often used. In the usual avoirdupois pound there are 7,000 grains—not to be confused with the grams of the metric system. There-

TREATMENT PLANTS

fore, 1 grain per gallon means 1 pound in 7,000 gallons: and 1,000,000 divided by 7,000 is 143 lbs. (nearly) per million gallons. Since 8.33 pounds per million gallons equals 1 ppm, 143 divided by 8.33 gives 17.1; and 1 grain per gallon is the same as 17.1 ppm, or 143 lbs. per mg.

There are two common methods of measuring temperature, Fahrenheit (F) and Centigrade (C). The F scale is commonly used for everyday reference to the weather; the C scale is used for scientific work. In the F scale, freezing is at 32 and boiling at 212, a difference of 180° between freezing and boiling. In the C scale, freezing is at 0 and boiling at 100.

To change an F to a C reading, subtract 32, divide the remainder by 9 and multiply by 5. Example: To convert 104 F to C; subtract 32, leaving 72; divide by 9 giving 8; multiply by 5, and the answer is 40° C. To change C to F, divide by 5, multiply by 9 and add 32. Example: To change 30° C to F, divide by 5, giving 6; multiply by 9, giving 54; add 32, and the answer is 85° F. The operator should be familiar with both scales.

Texts and Reference Data

A laboratory and some laboratory equipment are required for every sewage treatment plant. It is not necessary that the laboratory be large or the equipment costly. What is needed depends upon the tests that need to be performed and these depend, in turn, on local conditions.

A recommended set of laboratory equipment and a suggested layout for a laboratory can be obtained from your state sanitary engineer, or will be furnished by the Editor of this magazine on request.

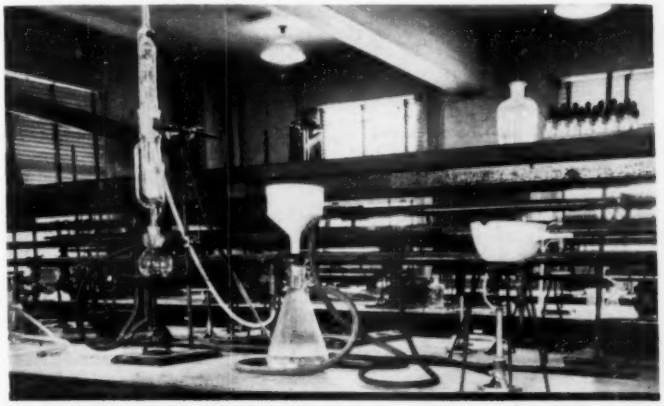
There are two books that are essential to the sewage treatment plant operator. These are: (1) *Standard Methods of Water and Sewage Analyses;* and (2) *Analysis of Water and Sewage,* by Theroux, Eldridge and Mallman. The latter text, and also *Operation of Sewage Treatment Plants* (published by International Textbook Co.) outline the required procedures for the various tests in a simple form.

If samples are collected improperly and do not give a true representation of the sewage to be tested, the analyses will be largely worthless, no matter how carefully made. Samples may be "catch", that is, a single pail, dipper or bucketful; or "composite," which are the combination of samples taken every hour or half-hour for 24 hours, proportionate in volume to the amount of sewage flowing at the time of sampling.

Tests for dissolved oxygen (DO) and pH must be made on fresh catch samples. Special equipment (and care) must be used in taking DO samples to prevent admixture of additional air with the collected sewage. Catch samples may be used for obtaining operating data, but results from them are subject to considerable variation. Composite samples should always be taken at sufficiently frequent intervals to provide adequate checks.

Directions for Sampling

Directions for taking and preserving composite samples over the 24-hour period are detailed in the books listed previously. The use of automatic samplers saves much time and simplifies the problem. These will take samples proportional to the volume of sewage flow and store them in a refrigerator, mixed and ready for analysis. Several of these were illustrated, and methods of sampling water-borne industrial wastes were described, in the April, 1950, issue of PUBLIC WORKS.



Courtesy Univ. of N.C.

● ***LABORATORY tests are important for good plant operation.***

OPERATION OF SEWAGE TREATMENT PLANTS

The directions given there also apply to sewage sampling.

In taking catch samples to show the results of treatment, allowance should be made for the time required for the sewage to pass through the treatment plant units. For instance, if the catch sample of raw sewage is taken at 8:30am, and if the detention time in the primary settling tank is 3 hours, the sample of the primary tank effluent should be taken at 11:30am. There is usually some short-circuiting, however, and the actual detention may be less than the theoretical. It is desirable to take a series of grab samples, at hourly intervals, of the raw sewage and the effluent from a settling tank, and to plot these on cross-section paper. If taken during periods of low, average and high flows, the operator will learn a great deal about the operation of his settling units.

When planning a sampling program, look the situation over and use judgment in order to get samples that are representative. Utilize your own knowledge of your plant. Exclude large solids. A 2-quart enameled dipper is handy for catch or grab samples. Tests should be made promptly; in general within 2 or 3 hours after the samples are taken. Read the sections on sampling in the books already listed.

An analysis of a sample of sewage may show the following results:

Total Solids	**980 ppm.**
Volatile Solids	**595 ppm.**
Non-Volatile Solids	**385 ppm.**
Suspended Solids	**270 ppm.**
BOD (5-day)	**226 ppm.**
pH	**7.0**

What do these mean in terms of what a man should know in order to operate a plant? These tests and certain additional ones which are of value in keeping on top of the operation job will now be discussed.

Total Solids — This means just what it says—the total solids in the sewage sample indicated above are 980 parts per million, that is, in a million pounds of this particular sewage there are 980 pounds of dry solids, for all solids are measured on a dry basis. In a million gallons of this sewage there will be (since a gallon of sewage weighs 8.33 pounds) 980 times 8.33, or 8,167 pounds of dry solids.

These solids should be classified further, if we want to know what the sewage contains. Some of the solids will be inorganic, as grit and sand, and some will be organic, as feces, pieces of vegetables, etc.

The grit and sand, and also such mineral compounds as carbonates, sulfates, etc., are called non-volatile or inorganic solids. These will not decompose. The organic material mixed with such grit and sand, unless carefully washed out, may make this material odorous after it has been removed from the sewage. But it is the organic or volatile solids that give the operator his job and most of his troubles.

To show how small the proportion of solids in sewage is, the 980 ppm, representing 8,167 pounds in a million gallons, amounts to only about 13 ounces in 100 gallons.

Making the Test—The total quantity of solids in a sewage is found by evaporating a known volume of the sewage and weighing the dry residue. A sample of 100 ml is generally used. Detail methods of performing the test are given in the texts already listed and will not be described here. A further step in this test—heating the residue to a red heat (igniting)—drives off the most of the volatile or organic matter, so that from this test the total solids, the volatile solids and the inorganic solids are all determined.

Suspended and Dissolved

Some of the solids in sewage are dissolved, as sugar is dissolved in coffee. Needless to say, these are difficult to remove. They represent about 60% or even more of the total. Other solids are colloidal in nature —actually in such very small particles that they cannot be removed by even a very fine filter, and, of course they will not settle out of the sewage.

Other solids are floating on or in the liquid and these are called suspended solids. A part of these, usually no more than half, can be removed by settling. In the analysis given, suspended solids amount to 270 ppm. A settling tank should remove about 50% of these and the effluent from a primary settling tank treating this particular sewage should show, on analysis, about 135 ppm of suspended solids. Actually this will depend on the condition of the sewage, and less will usually be removed when the sewage is stale.

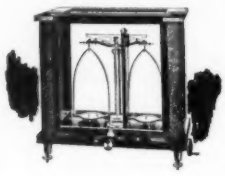
Settleable Solids—This test measures the amount of material that will settle during a quiescent period —usually 2 hours. The amount settled may be considered as ap-

SETTLEABLE SOLIDS

To determine the percentage of settleable solids by volume one liter of mixed sample is measured into an Imhoff cone and allowed to settle with occasional gentle stirring for 45 minutes, followed by 15 minutes without stirring. Read solids in ml. on scale at tip of cone.

TOTAL SOLIDS

A drying dish is ignited and its weight recorded. Then 100 ml. of sample is evaporated at 103°C., cooled in a dessicator, and weighed. Ppm total solids equals the difference in the weight of the residue (in mg.) times 10.



SAMPLING

Every effort must be made to obtain a representative sample, as outlined in this text. Shown below is the A.P.H.A. sampler designed to collect a sample free from entrained air bubbles for determination of dissolved oxygen content.

proximating the amount of solids that can be removed by ordinary sedimentation. Two or more Imhoff cones are used. These hold 1 liter; they are filled with well-stirred sewage and placed in a holder. After about 15 minutes, the cone is rotated gently, reversing the direction of rotation 3 or 4 times; and this procedure is repeated about 5 minutes before the final reading. The gentle movement permits material clinging to the sides of the cone to move down and also levels out the material at the bottom.

The amount of material settled may be read roughly by the graduations at the bottom of the cone. This does not give accurate results because the solid material is not closely packed. It is best to draw off the supernatant and determine the total solids as described previously.

The test should be made at the same hour each day and in the same manner. Adopt a standard operating practice and follow it. This should include washing the cones with soap and water and a long-handled brush after each use. If not washed carefully, a thin layer of grease may collect on the interior and interfere with the settling process.

Bacterial Tests—Bacterial removal is given scant consideration in most sewage treatment plants. Sewage, as it reaches the plant, may contain almost unbelievably large numbers of bacteria—a hundred million or more per cc. The treatment processes reduce the number, but the plant effluent still contains a great many bacteria. Except in unusual cases, where the effluent is heavily chlorinated in order to protect waters containing shellfish or for some other similar purpose, no attempt is made to control the numbers of bacteria. Therefore, bacterial tests are not made in routine sewage plant operation.

BOD—These three letters are a simple way of writing Biochemical Oxygen Demand. The BOD of a sewage represents the amount of oxygen necessary to stabilize the decomposable organic matter it contains.

The BOD of the sample considered above was 226 ppm. This means that 226 ppm of oxygen are necessary to satisfy the demands of the organic matter present during a stated period (5 days in this case). Remembering that 1 ppm equals 8.33 pounds per million gallons, there must be utilized by this sewage, in order to stabilize it, 8.33 x 226 or 1,883 pounds of oxygen per million gallons. It is the purpose of the various treatment devices discussed later to supply this biochemical oxygen demand.

As a matter of fact, it will take more than 1,883 pounds of oxygen. To accomplish complete stabilization of the organic matter requires several months. This is too long a period over which to run tests, and results obtained 3 or 4 months after the sample is taken are not of much value in guiding operation. Therefore in testing work, the results at the end of 5 days are usually taken. The BOD of 226 shown is the standard 5-day result. Experience has shown that under most conditions, the 5-day BOD is about 68% of the final BOD.

Actually, BOD values taken at different plants are not strictly comparable. Different sewages may have different rates of oxidation, depending on the so-called velocity coefficient k. It has been assumed that k is equal to 0.10, but examinations of various sewages have shown that it may vary considerably. Also, different treatment processes, while producing effluents yielding similar 5-day BOD results, may not be wholly comparable. An example is the high rate trickling filter as compared to the standard or low rate trickling filter. The high rate filter does not accomplish the same degree of nitrification that the low rate filter does, but this is not shown in the 5-day BOD results.

The presence of chlorine makes the results unreliable. The chlorine must be neutralized, and the sample seeded to get reliable results. Neutralization and seeding procedures are described in both the texts previously cited.

The collection of representative samples is important, and 24-hour composite samples are necessary for truly representative results. Short-time composites, as from 8am to 4pm, usually give results that are too high on the raw sewage and too low on the effluent, thus presenting an unduly favorable picture.

As already stated, the standard BOD test is the 5-day test. Much work has been done on the development of shorter and simpler tests; but none of these has so far gained acceptance.

Making the BOD test—This test employs small quantities of sewage, and good technique and considerable care are required for accurate results. It is recommended that operators arrange with their state sanitary engineer for instruction, preferably taking one or more of the short courses provided, usually at the State University.

Complete directions for procedures are given in Standard Methods and in Theroux, Eldridge & Mallman. If an operator desires to make this test, he should study carefully the directions given in these texts before beginning work, and should follow directions precisely.

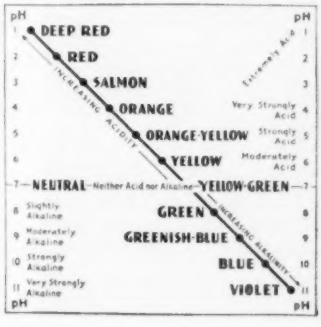
What pH Measures

pH—This is the measure of the intensity of the alkalinity or acidity of the sewage. A pH value of 7.0 shows that the sewage is neutral—neither acid nor alkaline. A value lower than 7.0 shows the sewage is acid, and greater than 7.0 that it is alkaline. The lower the value below 7.0, the more intense the acidity; the higher the value above 7.0, the more intense the alkalinity.

It should be remembered that the pH scale is based on a logarithmic function. Thus a pH of 5.0 represents an acidity 10 times as intense as does a pH of 6.0. Similarly a pH of 10, represents an alkalinity 10 times as intense as does pH 9, and 100 times as intense as pH 8.

Determinations of pH are valuable in sludge digestion and sludge filtration, and useful in plant operation. A daily record should be made at a selected hour each day; and additional tests at different hours in order to check variations are desirable.

Probably the most important use of such daily pH records is their ability to detect high acidities or alkalinities in the sewage which might adversely affect the sludge digestion process. The discharge of industrial wastes, whether due to



● ***AT RIGHT, a graph furnished by Hellige shows the color variation of their Wide Range Indicator over the pH scale, and the acid or alkaline characteristics of the pH values.***

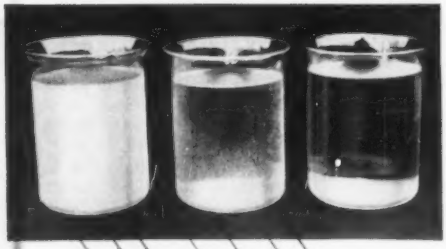
SEWAGE PLANT OPERATORS

For Clarification or Sludge Drying

INVESTIGATE THE ADVANTAGES

IN USING GENERAL CHEMICAL "ALUM"

Clarification



Above photograph illustrates effective coagulation and clarification of turbid waste by means of General Chemical Alum.

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Helps sludge digest readily

Speeds sludge drying with minimum odor

Produces clear, low-color effluents

Reduces chlorine consumption in effluent

Economical to use

Sludge Drying

Above: Sludge bed treated with General Chemical Alum to hasten dewatering.

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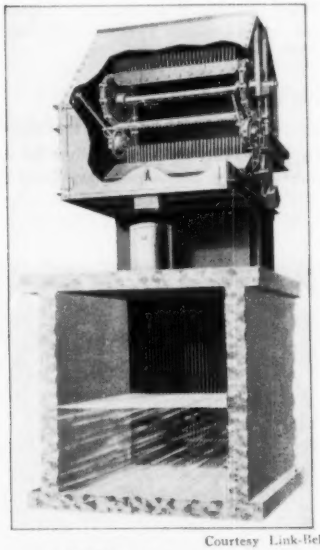
When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

accident or design, may so modify the sewage characteristics as to upset plant operation. Timely warning will permit remedial measures to be applied and the defect to be corrected. Any marked variation in pH from normal ranges should be investigated at once.

The Test—The pH value can be obtained by the use of indicators and a color scale, or by the use of electric pH equipment. The latter is of special value in sewage work where turbidity or color may make determination by the colorimetric method difficult.

Dissolved Oxygen — This test shows the amount of dissolved oxygen in the liquid, whether raw sewage, sewage effluent or water. Presence of dissolved oxygen in raw sewage is an indication of freshness; or it may indicate considerable ground water infiltration. Unpolluted surface waters contain as much dissolved oxygen as the temperature will permit, varying from about 14.6 ppm at freezing to about 7.6 ppm at 30° C. or 86° F. Therefore, the amount of dissolved oxygen in a stream may be a valuable indicator



Courtesy Link-Belt

● ***LARGE solids can be automatically removed with a screen.***

of its ability to receive, without nuisance, an additional load of organic matter.

Residual Chlorine—When sewage is chlorinated, the amount that is required is determined by the chlorine residual remaining in the sewage after 15 minutes contact. Experience has shown that if there is a residual of as much as 0.5 ppm after 15 minutes, the dosage of chlorine has been sufficient.

The test commonly used employs *orthotolidine* to give a color reaction in the presence of chlorine. Orthotolidine is most conveniently purchased in solution form from laboratory supply firms.

The test for chlorine residual is best made by using one of the standard comparator sets with orthotolidine. The starch iodide method described in Standard Methods may be used but is less convenient.

Where chlorine is used, the test for residual should be made daily (or oftener) at a standard time and the results recorded. A suitable point for taking the sample of sewage should be selected which (1) is truly representative; (2) provides the desired contact time. Occasional check samples at other places may be desirable.

The methods and purposes of using chlorine in sewage treatment are discussed in a later section of this text.

Methylene Blue Test—This test is a more or less rough measure of the stability of a sewage effluent. It represents the length of time that elapses before the sewage putrefies. It cannot be used on sewages that have been chlorinated; therefore when the sewage is chlorinated, the sample should be taken ahead of chlorination.

This test is an approximation of the Biochemical oxygen demand, but results from it cannot be converted into BOD results.

The methylene blue dye is purchased already made up, ready for use. Follow the directions in standard methods or in Theroux, Eldridge & Mallman in making up the bottles, which are held at 20° C (68° F) until the blue color disappears. The length of time required for decoloration indicates roughly the degree of treatment—the longer the better.

How to Report Tests—For all results but those for nitrogen, results are reported as follows: For ppm between 0.1 and 1, use two decimal places, as 0.55; between 1 and 10, use one decimal place, as 6.9; between 10 and 100, use the nearest whole number, as 43; over 100, use only two significant figures, as 130, not 134. When reports are tabulated, do not place zeroes at the right of the decimal point to fill out and balance columns.

Purpose of Treatment—It is not practical to remove all of the solids from sewage by any treatment processes, nor is it necessary. In most plants, the total solids are reduced only 25% to 40%. It is important, however, to change over the remaining solids into relatively stable forms, thus removing very largely their trouble-making characteristics. Thus, the sewage treatment plant is designed to: (1) Remove suspended solids, both organic and inorganic to a reasonable extent; and (2) convert the remaining organic matter into stable forms that will not further decompose with odor.

Operation of Grit Chambers

All sewage carries in suspension some sand, grit, and cinders. Combined sewers (those that carry both storm water and house sewage) carry most, but even in the small plant treating only ordinary domestic sewage, a considerable amount of inorganic material arrives in the sewage. In Imhoff tanks this makes the sludge hard to handle, and in separate sludge digestion tanks it may cause the same trouble. When sewage is pumped, such material causes rapid wear in the pumps.

Sand or grit may also clog or interfere with the working of valves and gates and, where there are inverted siphons, may wholly or partially clog these.

Removal Methods.—The sand and cinder particles being heavier will settle more quickly than the organic matter in the sewage. Removal is therefore accomplished by providing an area for settling and reducing the velocity of the sewage to about 1 foot per second, at which velocity the sand and other grit will settle, while the organic matter does not.

The flow of sewage varies, being larger during the day than at night. It is therefore difficult to design a grit chamber that will provide the same velocity for all volumes of flow. In older designs this was usually accomplished by providing such grit chambers with two or more channels or compartments, one or more of which were used, depending on the volume of flow. In newer mechanical units, other provisions are made.

Types of Grit Chambers.—Older plants are commonly equipped with a type of basin which requires hand cleaning. In actual operation, except in large plants, cleaning of these devices is difficult and disagreeable and they are liable to be neglected.

Modern devices include the Dorr "Detritor," and the Link-Belt grit collector. These provide for mechanical removal and washing of the grit, so that the material removed is rela-

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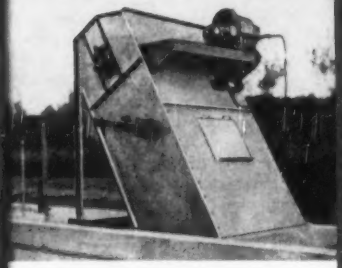
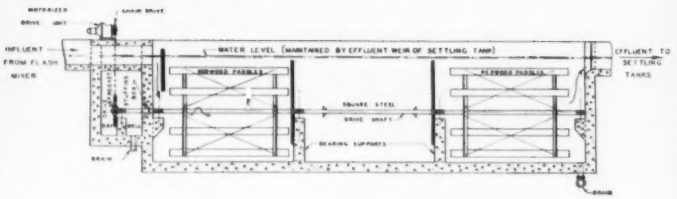


TRITOR SCREENS

—are used for the removal of screenings and grit at small sewage treatment plants. With the Tritor Screen, one mechanism accomplishes removal of both grit and screenings. Send for Book No. 1587.



HORIZONTAL SLOW MIXERS

—for rectangular tanks where horizontal flow is desired. The degree of mixing can be reduced as the water flows through the tank by decreasing the number and changing the pitch of the paddles. Send for Folder No. 2042.

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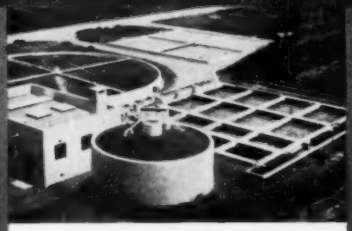
—for rectangular settling tanks, Straightline Collectors with peak-cap bearings, pivoted flights and "Straightline" action provide a combination which can't be beat for efficient collection of sludge and grease. Send for Book No. 1742.

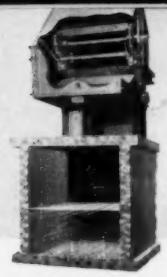
CIRCULINE SLUDGE COLLECTORS

—for round settling tanks. Circuline collectors are equipped with "Straightline" action which assures quick and positive sludge removal from the entire tank floor in one revolution. Send for Book No. 1982.



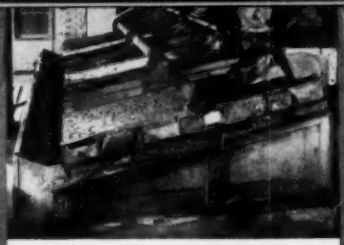
BIO-FILTRATION SYSTEMS

This system consists of high rate shallow filters and recirculation of the effluent from the filter to the settling tanks. Features are: great flexibility, high rate of B.O.D. loading and the ability of plants to handle strong domestic and industrial sewage in single-stage or two-stage treatment, as required. Send for Folder No. 1881.



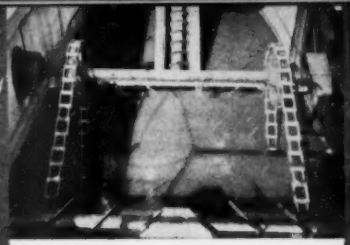
THRU-CLEAN BAR SCREENS

—a coarse bar rack and chain operated rakes equipped with fingers that clean through the rack from the back. The screen cannot be jammed by large objects since the rake will enter under and lift them. Send for Folder No. 2327.



LIQUID VIBRATING SCREENS

—an efficient and economical screen for the removal of solids from industrial liquids. Units are available in several sizes with coarse or fine screen medium. Send for Book No. 1977-A.



STRAIGHTLINE GRIT COLLECTORS

—for the removal of a clean, washed grit with a low putrescible content, the collecting and thorough cleaning operation with Link-Belt grit washer makes further handling unnecessary. Send for Book No. 1942.

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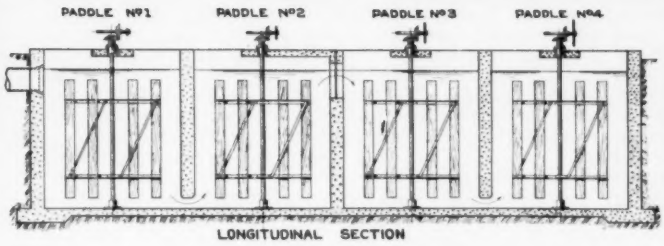

LONGITUDINAL SECTION

VERTICAL SLOW MIXERS

—for square tanks which can be constructed singly or in a series of two, three or four. These mixers will provide efficient mixing and flocculation where vertical flow is desired. The mixers can be operated at a decreasing rate of speed to produce the maximum size floc. Send for Folder No. 2042.


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—for rapid and thorough mixing of chemicals with water, sewage or industrial liquids. A large, efficient four-blade propeller operates with or without under water bearing. Send for Folder No. 2042.

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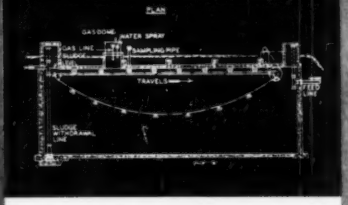

STRAIGHTLINE SCUM BREAKERS

—are used in either round or rectangular digestion tanks to break up the floating scum, paddle it down and submerge it. The scum breaker consists of two stands of chain with pitched flights between them, traveling at a slow speed. Send for information.

● Link-Belt manufactures a complete line of equipment for Water, Sewage and Industrial Liquids Treatment Plants and have applied this equipment effectively to the solution of such problems. Link-Belt engineers have cooperated with consulting, municipal and sanitary engineers, and plant operators in planning and operating plants, for positive results and highest efficiency. For information on any of the above products, write your nearest Link-Belt office.

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tively clean and unobjectionable. Jeffrey has grit removers of several types. Chain Belt uses a bucket type remover.

Operation.—When modern mechanical equipment is used, operation consists of (1) final disposal of the washed grit, which can be used for fill; and (2) lubricating and maintaining the equipment in accordance with the manufacturer's directions.

In the older types of grit chambers, cleaning is necessary after every heavy storm, and also when it is determined by measuring with a pole marked to feet and inches, that the channels are half full or more. In dry weather, measurements should be made once a week. Removal is accomplished by shutting off the flow in the compartment or channel to be cleaned, pumping or bailing out the sewage, and removing the residue with shovels, pails or, in large plants, with grab buckets. Such grit usually contains so much organic matter that it should be buried; but if sufficient space is available it may be dried on sludge beds at some risk of causing odors.

Operating Records.—When mechanical washing and removal apparatus is used, a daily record should be made of the amount (generally in cubic feet) of material removed. This may be entered on the daily report in a column adjacent to the volume of flow and to the volume of screenings.

When grit chambers must be cleaned by hand, the dates of cleaning and the amount of material removed should be noted; also days since last cleaning and notations regarding storms.

Operation of Screens

The purpose of screens is to remove large objects in the sewage. Such objects tend to clog pumps and pipe lines and to interfere with plant operation.

The term screens, as used here, refers to a screen made of iron bars spaced ½ inch or more apart. The bars are usually set at an angle to facilitate cleaning. Cleaning is done by hand, or by a rake on the mechanically cleaned screens. Hand cleaning is a disagreeable job, often neglected; mechanically cleaned screens are therefore very preferable.

On hand-cleaned screens, an area between the bars about twice as great as the area of the entering and leaving sewer is desirable.

Type of Screens.—In addition to the hand cleaned screens, there are several types of mechanically cleaned machines. These include Link-Belt, Dorr, Jeffrey, Chain Belt, and others.

In addition to convenience, mechanically cleaned screens are more effective than hand-cleaned screens because cleaning is more frequent. In the small plant, screens are raked by hand only once or twice a day, as a rule, whereas the mechanical screen can be set by a timing device to operate as desired, as 3, 5, 10, 30 or 60 minutes, or intermediate intervals. As a result, about twice as great a volume of screenings is removed and the load on other units of the plant is correspondingly reduced.

Operation of Screens. — Hand cleaned screens should be cleaned several times a day, otherwise the sewage is backed up by the material caught on the screens. This not only may cause deposits in the entering sewer, but may also force some of the material through the screen thus rendering it less effective. The screen chamber should be hosed and squeegeed weekly, or oftener in warm weather.

Mechanical screens should be lubricated in accordance with the manufacturers' suggestions. The screen, buckets, and the screen chamber should be hosed daily to keep them clean, and the chamber walls squeegeed at weekly intervals. The entire mechanism should be painted annually. Slack in chains should be taken up in accordance with manufacturers' directions. Spare links should be stocked.

Disposal of Screenings. — The screenings removed from the sewage are very disagreeable. Prompt and sanitary disposal is necessary. Grinding is a good method of disposal, Mechanically cleaned screens may discharge direct into wheelbarrows or into closed cans. Burial is the most common method of disposal. A trench at least 3 feet deep is necessary, and spraying the screenings with creosote or covering with tar after dumping them into the trench is desirable. Cover at once and thoroughly with at least 18 inches of compacted cover. At some small plants, screenings are placed in the digester. A small incinerator is excellent for disposal.

Screening Shredders.—There are available screenings shredders which cut or grind the screenings to small bits and return these to the sewage for final disposal by sedimentation and digestion. These are made by Chain Belt, Jeffrey, American Well Works, Gruendler, Infilco, and Chicago Pump.

Grit should be removed before comminuting, otherwise the cutting edges of the teeth wear and must be sharpened. Teeth should be resharpened by the manufacturer before wear becomes excessive.

Record of Operation. — Records should show the amount of screenings removed daily, which is easiest measured by noting the capacity of the container used and the number of times it is filled. On mechanically cleaned screens, a record should be made of the time between strokes—as 5 minutes or 10 minutes; also of the amount of material removed. When the screen discharges directly into a grinder or when a comminutor is used, there is commonly no record of the amount removed, but measurements may be made at intervals for purposes of record.

Mechanically Cleaned Sedimentation Tanks

THIS section covers operation of sedimentation tanks equipped with apparatus for the collection and removal of sludge. It does not refer to septic tanks, to hopper bottom settling tanks, nor to Imhoff tanks, on which a separate section has been prepared.

Purpose of Sedimentation.—The purpose of sedimentation is to remove as much as possible of the solids carried by the sewage, specifically those that will float or settle out, to separate this material from the sewage and to treat and dispose of it separately. Such treatment does not produce a "pure" effluent; it does, however, represent a considerable step forward in the process of treatment. From 40% to 60% of the suspended solids are ordinarily removed and from 10% to 30% of the total solids.

Design of Settling Tanks.—Settling tanks are generally circular or rectangular in shape, but some are square. The rectangular, with a length four or five times the width, and the circular are most common. Most tanks are not over 9 or 10 feet in depth, since experience has shown these are as effective as deeper tanks and cost less to construct. The capacity of the tanks—the width times the length times the water depth—should be equal to the aver-

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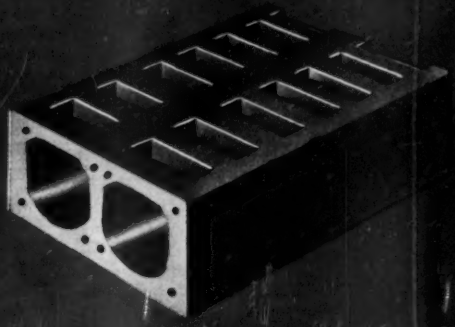

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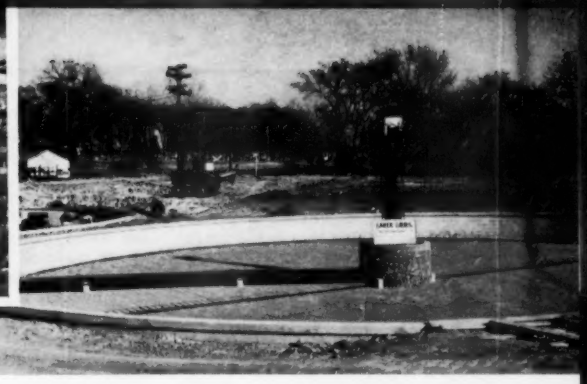

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age flow of sewage over a 2 or 3 hour period. For instance, a tank 70 ft. long, 10 ft. deep and 15 ft. wide has a capacity of 70 x 10 x 15 = 10,500 cubic feet, or 78,750 gallons. With a detention period of 2½ hours, such a tank would treat 78,750 x 24 ÷ 2.5 = 756,000 gallons per day.

A circular tank 40 ft. in diameter and 10 ft. deep has a capacity of 40 x 40 x .7854 x 10 = 12,656 cu. ft. or 94,250 gallons, and with a detention capacity of 2.5 hours, would treat about 905,000 gallons per day.

To find the capacity of your own rectangular settling tanks in gallons, multiply the length times the width times the average water depth by 7.48; and, in the case of circular tanks, the diameter times the diameter times the depth times .7854 times 7.48.

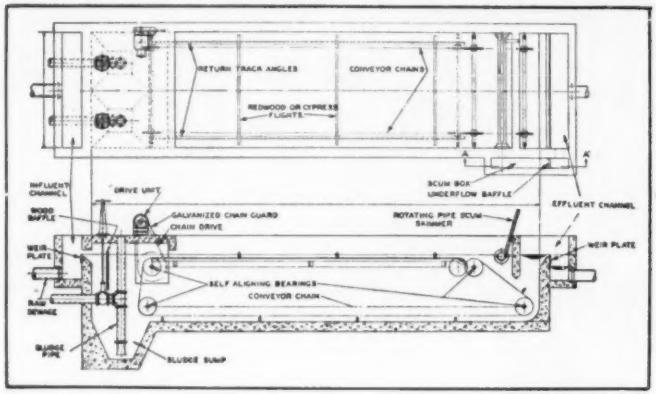
Tank area is also important; primary settling tanks normally are rated at 800 to 1000 gallons per sq. ft. of surface area for 24 hours.

Operation of Tanks.—Sludge is removed continuously in some plants, and two to four times a day in others. Continuous removal reduces floating scum and may result in thicker sludge.

The sludge is drawn from the sludge sump in the bottom of the tank by means of pumps, which also usually operate twice a day on small plants and continuously on large ones, discharging sludge into the digestion tank. In this type of operation, the operator should take frequent samples of the sludge being drawn (provision is usually made for easy sampling) and adjust the pump capacity so that all of the sludge is drawn, but no more. If sewage is being drawn, the pump should be regulated to draw from the tank at a slower rate.

When the collectors are run intermittently, as for one hour twice a day, the pumps should be started after one-half revolution of the scrapers and should be allowed to run as long as they draw good sludge from the tank. Collectors should be stopped when the sludge becomes thin. A common trouble is excessive pumping to digesters, resulting in digestion difficulties, too much supernatant and a heavy load on secondary treatment processes.

When the sludge is drawn by hydrostatic pressure, that is by the pressure of the sewage in the tank, the valve on the pipe is opened part way, and the sludge allowed to flow out; when the sludge becomes thin, the valve should be closed. Most plants utilizing this method are so designed that the operator can see the sludge as it is being drawn, and can judge when the valve should be closed.



Courtesy Jeffrey

● ***TYPICAL details of a rectangular settling tank are shown above.***

Some floating material collects on the top of the tanks. Mechanical apparatus is now commonly used to remove such material. Where it is not available, hand removal at least once a day is necessary. Appearance is the principal factor for guidance in this. Skimmings are usually placed in the sludge digestion tank. Most plants are so designed that these skimmings may be swept into a trough which discharges into the digester or into the pump sump so that further handling is not necessary.

The side walls of the settling tank sometimes collect fine solids, which in warm weather decompose; also at the water line, some grease is deposited. This should be removed daily with a stiff brush or with a squeegee, and the walls washed down with a hose, care being taken not to disturb the tank contents more than is necessary. It is desirable to squeegee the side walls of the tank to prevent the deposit there from peeling off and coming to the surface as dark floating pieces of organic matter. This is not easy, but is necessary in warm weather. Rising gas bubbles indicate improper or inadequate sludge removal.

The inlet channel should be washed out with a hose every day and scrubbed at least once a week, using a stiff broom; the same treatment should be given to the outlet channel and to the baffle.

Manufacturers furnish with their equipment a lubrication chart which shows where to oil and grease and tells what kind of lubricant to use. These instructions should be followed carefully. The motors and reducers are complicated pieces of apparatus, and even though the collector itself travels slowly, this is only because of gear reducers, parts of which travel at a high speed. If the lubrication chart has been lost, write to the manufacturer of the sludge collecting apparatus and ask for another one.

At some plants it is the policy to empty a tank every six months, inspect the machinery and make necessary adjustments. This may be desirable with new plants. Sewage should not be by-passed into a stream during inspection.

Records of Operation.—For sedimentation tanks of this type, the records of operation should include at least the following: When and for how long the collecting apparatus is run; volume of sludge removed, preferably in cubic feet per million gallons; the solids content of the raw sludge; temperature of the sludge removed; pH of the sludge; settleable solids daily of both the raw sewage and the tank effluent; and average detention period.

Activated Sludge Plant Operation

There are two general types of activated sludge plants—diffused air and mechanical. General features of operation are similar. The sewage is first settled in sedimentation tanks and the partly clarified effluent then flows into aeration tanks. As the sewage enters the aeration tanks, activated sludge is added to it. This sludge, which in volume amounts to 20% to 30% of the sewage flow, is drawn from the final settling

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5. **EASIER TO LOCATE.** The small size, well landscaped, sewage treatment plant provides the extra advantage of location close in, sometimes in the midst of a residential area, as it is a good looking building and emits no odors.

6. **ALL WEATHER OPERATION.** Vacuum filters operate in all types of weather. Rain, snow, blizzards or high humidity do not affect the efficient operation of vacuum filters.

7. **SLUDGE AS FERTILIZER.** Properly treated sludge has found a ready market as a fertilizer. Some plants defray a portion of their expenses by selling this product.

8. **LOWER FIRST COST.** Taking all factors into consideration, such as labor and materials, time, real estate, trunk sewer costs and digestor size, the savings permitted through the use of an Eimco Continuous Vacuum Sludge Filter will more than offset the cost of the equipment.

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tanks. After passage through the aeration tanks, which requires 5 to 7 hours, during which time the sewage-sludge mixture is continually aerated, the sewage is discharged to the final settling tanks. A considerable portion of the sludge collected in the final settling tanks is returned to the inlet of the aeration tank; the remainder must be disposed of by digestion or other means.

Air for agitation and aeration is supplied, in the case of diffused air plants, by means of blowers which force air through specially constructed diffusers in the bottoms of the tanks; and a similar action is obtained in mechanical plants by aerators. Agitation is necessary to keep the mixture of sludge and sewage in motion, so that the particles will not settle and so that the activated sludge particles have intimate contact with sewage. Air, either diffused as very small bubbles, or obtained from the atmosphere by mechanical aeration, is necessary to maintain aerobic conditions in the plant.

Operation of Sedimentation and Aeration Units.—Since the action in an activated sludge plant is biochemical, conditions in the aeration tanks should be maintained on a uniform basis at all times. Heavy loads of strong sewage; strong overflow from the digester; or large and rapid increases in flow of sewage must be cared for by providing an adequate return flow of active sludge. Where possible, supernatant liquor that contains 3,000 ppm or more of suspended matter should be disposed of otherwise, or pretreated, before discharge into the settling tank.

Frequent tests for dissolved oxygen should be made on the plant effluent and in the aeration tanks. The presence of more than 4 or 5 ppm. may indicate over-aeration or an improper distribution of air. Most air should be supplied at the inlet end of the aeration tank — plants are usually designed to apply one-half of the air in the first 25% of the tank length. This tapered application of air is desirable for economy and effectiveness of operation.

The control of solids in the aeration tank liquor is important. Since each activated sludge plant is a law largely unto itself, each operator must determine from his own personal experience at his plant the amount of solids that gives the best and most economical results. If the solids content is too great, the air supply may be deficient and inferior treatment may result. If there is a deficiency of solids—that is, not enough to produce the necessary concentration of activated sludge in the aeration tank, inadequate treatment will result. Under usual conditions at most plants, 2,000 to 3,000 parts per million of solids are carried in the aeration-tank liquor of diffused-air plants, and 300 to 900 ppm. in mechanical aeration plants. As previously stated, this factor must be varied with the strength of the sewage.

Thus activated sludge must be added to the incoming sewage, as it enters the aeration tank, on the basis of volume of flow as well as strength of sewage. Sludge must be stored in the final settling tank to meet these needs, but since the stored sludge deteriorates rapidly, good management is necessary, as will as a knowledge of local conditions of flow, strength, etc.

Bulking.—The sludge index test in diffused air plants will normally give values between 50 and 150 and in mechanical-aeration plants between 200 and 300. An exceptionally large value for the sludge index generally indicates that bulking is taking place in the final settling tanks. When bulking occurs, the sludge particles are large and fluffy and may tend to rise instead of settling. Bulking may be caused by the growth of a thread-like fungus, which brings about an unbalanced condition in the miscroscopic life existing in the aeration tank. Industrial wastes, notably starches from canneries, or the introduction of a stale or septic sludge will deplete the available oxygen and tend to cause the unbalanced condition just mentioned. The cause of bulking should first be determined. If industrial wastes are the cause steps should be taken for their treatment at the plant site. Increased aeration may effectively control the fungus growth and bring the return of normal conditions. Chlorination of the return sludge, or the addition of lime have been helpful. Chlorine dosages up to 6.0 or 7.0 ppm. have been successful, but smaller application should be used initially.

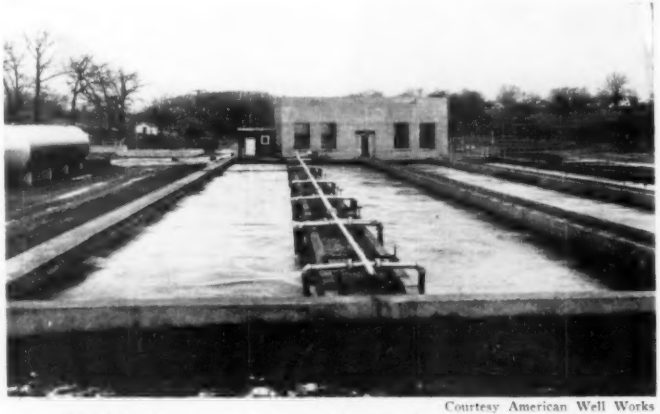
Operating Records.—In addition to the general records already discussed, records on activated sludge plant operation should include: The amount of return sludge; the sludge index; D.O. and nitrates in the plant effluent; and a record of the results of each plant unit.

SLUDGE INDEX

To determine the sludge index, sample is allowed to settle for 30 minutes in a graduated cylinder. The sludge volume is then observed and recorded as a percent of the total volume. Sludge index equals this figure divided by percent of suspended solids.

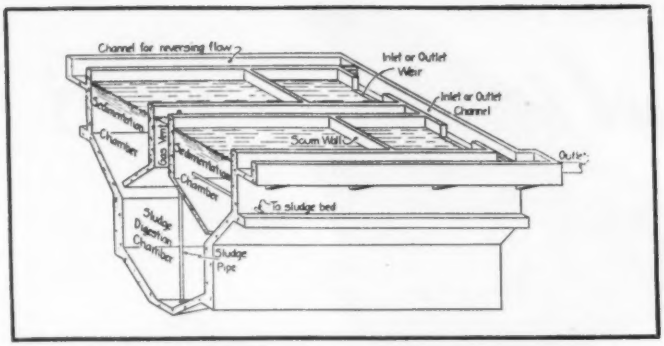
Operation of Imhoff Tanks

The Imhoff tank acts both as a sedimentation tank and as a sludge digestion tank. It is, in effect, a two-story tank. The upper part is a settling tank; the lower part stores and digests the solids that settle out



Courtesy American Well Works

● ***AERATION tanks at a municipal activated sludge plant.***



● ***SECTIONAL drawing shows Imhoff tank compartments.***

of the sewage. These pass through a trapped slot in the bottom of the settling compartment and are retained in the sludge compartment until digestion has progressed far enough so that the sludge may be dried on sand beds. The sketch herewith illustrates the three important parts of an Imhoff tank—the settling compartment, the sludge compartment and the gas or scum vents.

The settling compartment is designed to provide a retention period of 1½ to 3 hours—usually about 2 hours. The sludge digestion compartment is usually designed with 3 to 4 cubic feet of capacity for each person it is expected to serve. The scum or gas vents should have an area of from 20% to 30% of the area of the tank surface.

The inlet and outlet channels should be kept clean with a scrubber or squeegee and hose. Some Imhoff tanks are equipped with channels and gates for reversing the flow. Such gates and channels should also be kept clean, and the flow should be reversed about twice a month. The heavier and bulkier solids in sewage settle quickest. Therefore that part of the tank nearest the inlet receives most of the solids and may fill and require emptying before there has been time for digestion. Reversing the flow aids in getting equal deposits of sludge.

Sedimentation Compartments. — Grease and scum should be skimmed of the tank surface daily or oftener. Careless skimming may break up the solid matter in the scum and permit it to be carried out in the effluent. The material skimmed off may be placed in the gas vents, or burned or buried. The sides, ends and sloping bottoms of the sedimentation compartment should be scraped frequently—every day or every other day in warm weather and weekly or twice a week at other times. The material that clings to the walls should be pushed down through the slot. The slot should also be kept clean. A chain drag is sometimes used for this purpose. The slot should be cleaned from one to three times a week.

In cleaning the walls and slot, unnecessary turbulence or stirring up should be avoided. Material in the sludge compartment should not be brought up into the settling compartment. The Imhoff tank is designed to keep the decomposing material in the lower chamber out of contact with the sewage in the settling chamber. Experience has shown that better settling and a fresher effluent results from this separation.

Gas Vents and Scum Compartments.—Floating solids from the digestion chamber rise into these openings; also gas produced by the digestion of the sludge escapes through them. The scum may become very heavy at times. It is desirable that this floating material be broken up from time to time to permit the escape of gas and prevent the formation of solid masses of dry or partly dry material.

This breaking up of heavy material in the gas vents can be done with a rake or hoe; by using a fairly large hose under considerable pressure; or by pumping sewage preferably from the upper part of the digestion compartment with a small force pump. This is returned through the gas vents and does not tend to cause flow between the upper and lower compartments. For the same reason, too much water should not be used.

The scum, if quite dry, may be removed with shovels and placed on the sludge drying bed for complete drying out.

Lime may be added as a solution and well mixed, or washed in with a hose. The addition of lime aids in maintaining an alkaline reaction, which is desirable for proper sludge digestion.

In cold weather, when the scum tends to freeze, holes may be punched through it to allow the gas to escape.

The Sludge Compartment. — The sludge digestion compartment is inaccessible, as well as out of sight. Therefore operation must be based on pH readings, on the appearance of the sludge and on soundings to determine the depth of the sludge deposit.

The pH of the sludge should generally be 7.2 to 7.6. An acid sludge may result in foaming, which is discussed hereafter. Well digested sludge is usually dark, rather granular and without disagreeable odor.

The depth of sludge may be determined: 1. By a pitcher pump with a weighted suction hose marked at 1- or 2-ft. intervals. Lower the hose through the gas vent or slot, working the pump handle. When thick sludge comes through the pump, or the pump chokes, as it usually will with thick sludge, the depth is determined; 2. A weighted wooden block, or iron plate 12 ins. square is lowered. Reduction in weight on the graduated chain or wire indicates depth. (This is not generally very satisfactory.) 3. A metal can or bottle, with a stopper and spring fastened to a rod; the stopper is pulled out with a wire.

Sludge should be drawn whenever it approaches within 18 ins. of the bottom of the slot or trap in the sedimentation chamber.

Drawing Sludge.—Sludge should be removed at a slow and regular rate; at comparatively frequent intervals; and not all the digested or ripe sludge should be removed. Usually not more than one-half of the depth of sludge should be removed at once; less is better.

Sludge in an Imhoff tank tends to become quite solid and firm, especially where there is much silt or sand in the sewage. If the sludge is drawn at a rapid rate, a hole may be formed that will draw undigested sludge or even sewage, while some of the digested sludge remains in the hopper.

Drawing of sludge is best accomplished by opening the draw-off valve part way, meantime pushing the sludge toward the bottom of the hopper with a long rod having a cross piece attached. A hose may be let down through the sludge pipe and water forced through to loosen

(*Please turn to page 64*)

Interested in BIG SCALE sludge digestion ?

Aerial view of Los Angeles Hyperion Sewage Treatment Plant. Insert—Closeup of one of the Dorr Primary Digesters at Hyperion.

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the sludge. Care should be taken to have a vacuum breaker on all water connections to a sewage plant. Otherwise a hose so used and left immersed would constitute a dangerous cross-connection to the water supply. In summer, sludge normally will be drawn about once a month; in the winter only when the sludge in the tank reaches within 18 inches of the slots. After the sludge is drawn, the sludge piping should be flushed out with water and, where freezing is no hazard, the pipes should be left full of water to prevent sludge hardening in and clogging the pipes. It is often advisable to draw down the sludge in the late summer and fall to provide storage space for the winter.

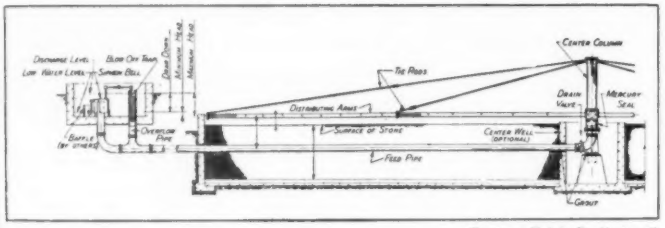
Foaming. — Gas vent contents sometimes become light and foamy and literally "boil over." This condition is called "foaming." It may be caused by industrial wastes from milk plants, canneries, breweries, etc., which turn sour in the tank; or it may be caused also by drawing too much sludge, by overloading the sludge chamber, by rapid increases in temperature of the sludge; or by a combination of reasons, often undetermined.

If the cause can be determined it should be removed. If diagnosis of the trouble is not possible, various remedies may be tried, including: Putting the tank out of service temporarily, if another is available; drawing a small amount of sludge; adding lime through the gas vents; breaking up the foamy scum; and prechlorination of the sewage, using three to ten ppm. of chlorine.

Operation Records.—The following records of Imhoff tank operation are desirable:

1. Settleable solids in raw sewage and in effluent, daily, by means of Imhoff cones.
2. Record of skimming sedimentation compartment.
3. Record of cleaning slots.
4. Record of breaking up scum.
5. pH of sludge (daily or weekly record).
6. Amounts of sludge drawn and dates of drawing.
7. Moisture and volatile contents of sludge.
8. Record of sounding for sludge depths.

Trickling Filter Operation



Courtesy Ralph B. Carter Co.

● ***SECTION through filter showing distributor and dosing tank.***

A trickling filter consists of a bed of broken stone, 3 to 6 or 8 feet in depth. The sewage is applied intermittently as a spray to the surface of the bed, trickles down through the stone and is collected by underdrains at the bottom. The filter is usually built with a concrete bottom and with stone or concrete walls to retain the broken stone. Application of the sewage is by spray nozzles or rotary distributors, which have been used on nearly all recent installations. The rate of application for standard filters is usually 300,000 to 500,000 gallons per day per acre per foot of depth, based on average flow.

High capacity filters operate at very much higher rates—from 10 million to 25 million gallons per acre per day. Some of these utilize recirculation of the effluent.

Only settled sewage, that is sewage that has been passed through a settling or Imhoff tank, should be applied to trickling filters.

The stone particles, are, of course, too large to strain out the suspended matter in the sewage. Purification is effected by the organic film which forms on the surface of the stone. The sewage trickles in thin sheets over the organic film. This film contains aerobic bacteria which oxidize and stabilize the organic matter in the sewage. There is a considerable reduction in bacteria, in organic content and in BOD. However, the effluent from a tricking filter, like any other sewage effluent requires careful disposal.

Care of Nozzles and Orifices.—All clogged spray nozzles or orifices in revolving distributors should be cleaned as soon as clogging is noticed. To reduce trouble a fine screen may be placed in the discharge channel of the sedimentation tank or the inlet to the dosing tank; to prevent trouble from grease, keep the dosing tank free from accumulations and deposits.

The Dosing Tank.—The dosing tank takes the flow from the Imhoff or settling tank, holds it temporarily, and then discharges it at a controlled rate through a siphon, to the nozzles or orifices onto the bed. The interior of the dosing tank used for spray nozzles has one or more sloping sides to insure that all portions of the area around each spray nozzle receives an equal dosage of the sewage. Thus, when the dosing tank is full and begins to discharge, there is a greater head and the nozzles spray over a wider area, but as the head becomes less in the dosing tank, the nozzles spray a less area. The tank is made smaller at the bottom so that the smaller areas sprayed with the lesser heads will receive the same dosage per square foot.

A siphon controls the flow from the dosing tank. When the tank becomes empty, the siphon cuts off the flow to the nozzles, permitting the tank to fill again and repeat the cycle. Operation is controlled by air compressed under the bell of the siphon by the rising sewage.

Perhaps the most common difficulties in the operation of dosing tanks are due to air leaks in the control piping. This may result in the siphon discharging before the tank is filled, in which case only that portion of the filter nearest the nozzle is dosed or the distributor fails to revolve.

Occasional cleaning of siphon air and water lines is desirable, special precautions being taken with the connections of the air pipes to prevent leaks. Air leaks are difficult to locate, and in case of continued trouble from this source, it may be cheaper to replace all air piping with new lines.

Grease and other solids accumulate in dosing tanks and may cling to the sides, especially at the high water line. This material dislodges and may pass through the siphon and clog the nozzles. It should be removed regularly to prevent such accumulations.

Pooling or Ponding.—Pools or ponds sometimes form on the surface of the filter. This is usually

(*Please turn to page* 68)

Which filter pioneered continuous mechanical sludge dewatering, making the elimination of sludge beds practical and economical?

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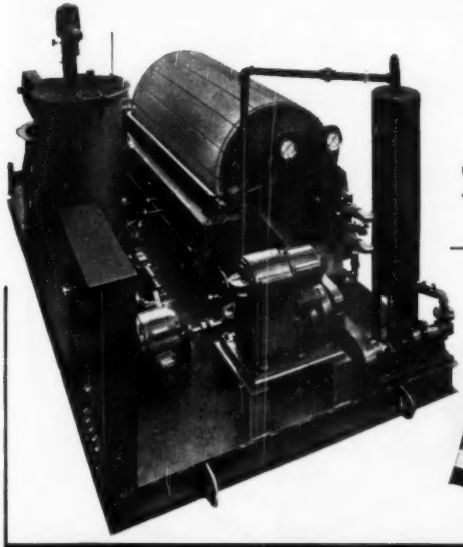

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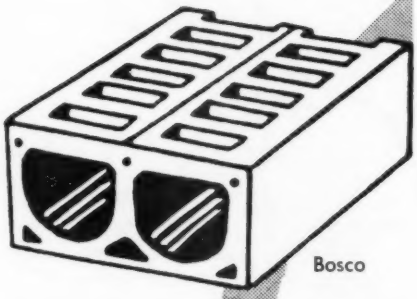

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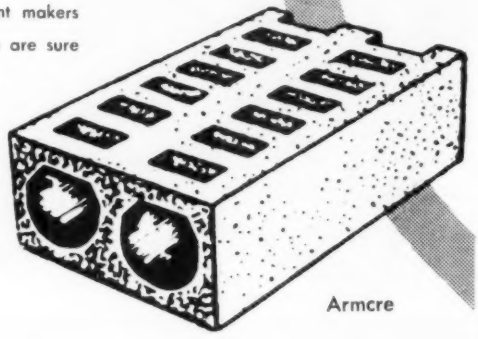

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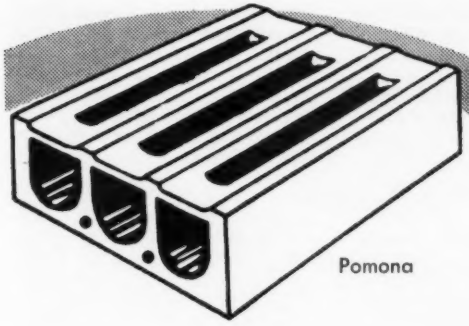

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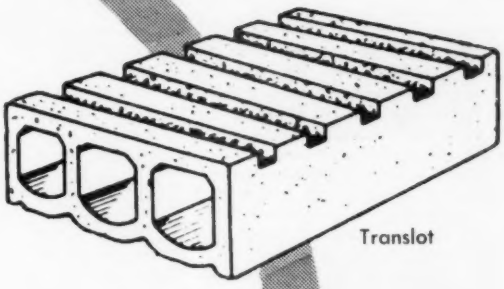

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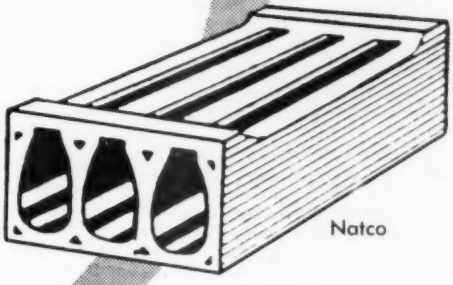

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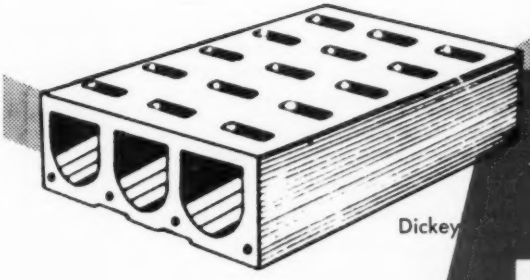

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due to organic growths or to retained organic matter from poorly settled sewage. Sometimes it is due to carelessness in dumping fine materials in one place when building the filter. When this is the cause, the fine material must be removed and replaced with suitable stone.

Sometimes the trouble lies in the top layer of the stone, and forking or raking the stone to a depth of 8 to 12 inches or so is effective. Other methods include washing the surface of the bed with a heavy stream from a fire hose; taking the bed out of service for 24 to 48 hours, if this can be done without detriment o the quality of the effluent; flooding the bed for about the same period, if the bed is so constructed that it can be flooded; or by applying rather heavy dosage of chlorine to the ewage before it reaches the bed.

Application of 3 to 5 ppm. of chlorine has been found helpful; in some cases, dosages up to 10 ppm. have been used. Caustic soda has also given good results with dosage of about 10 ppm. When using chemicals, as chlorine, treatment may be given for 8-hour periods on alternate days.

Filter Flies.—The larvae of the filter fly (Psychoda alternata) may cause clogging or impair the efficiency of the filter. The adults may be present in such numbers as to be a nuisance at the plant and at houses within a quarter or half mile of the plant.

The flies lay their eggs in the filter film; the incubation or development period depends on the temperature, but is about 9 days. The larvae can be drowned by flooding the filter for a 24-hour period at intervals of 9 or 10 days. Chlorination, as directed in the preceding article, using 3 to 5 ppm. of chlorine is reported to be effective, if application is made every 7 to 10 days.

DDT and other insecticides have been used for control of filter flies. Often a strain or breed of flies develop that are resistant to the particular chemical being used, so that a change is desirable. In addition to DDT, Chlordan and BHC (benzenehydrochloride) may be used. In computing applications, 1 ppm based on the daily flow of sewage is normal practice, but this is applied during a short period, usually 2 hours or so, using an equivalent rate, as 12 ppm for 2-hour application. The chemical may be added to the dosing tank or other suitable spot. The 1 ppm dosage is based on the amount of active chemical and no allowance is made for the carrying vehicle. None of the above chemicals appear to affect filter efficiency when used in the amounts recommended.

Adult flies can be killed by using any of the commercial fly or insect sprays, or by burning with a blow torch, but these methods are possible only after the nuisance has been produced. Prevention is far better.

In most plants using spray nozzles each line of distribution piping is provided with a plug or valve so that the line can be flushed out. Where such provision has not been made, the spray nozzle at the end of each line can be removed during a dosing period. This will usually give sufficient velocity through the line to flush it out.

High-Capacity Filters.—The general directions outlined above apply also to high-capacity filters of the Biofilter, Aerofilter or Accelo-Filter types. In the Biofilter, a portion of the effluent from the filter is recirculated to the primary settling tank and, by dilution, lowers the BOD of the raw sewage. The application to the filter surface is at a much higher rate and the BOD load applied may be 2400 to 3200 pounds per acre foot. Uniformity of operation procedure and maintenance of adequate recirculation, which may be varied in some plants in accordance with flow and strength of sewage, seem to be important.

The aerofilter applies the sewage in a very fine spray. Recirculation is utilized only at very low flow periods. The Accelo-Filter utilizes recirculation to the distributor, with a BOD loading about the same as the others and an application rate of 10 to 13 mgad.

Filter flies are not normally numerous at high capacity filter plants.

Odors and Prevention.—If the sewage is septic, spraying it into the air liberates the contained hydrogen sulphide gas, causing odor. This occurs also, but not to the same extent, with the rotary type distributor.

Odors must be controlled by eliminating the causes before the sewage reaches the nozzles. Prechlorination is probably most effective and economical. This is described more fully in the section on chlorination.

Records of Operation. — The operating record should show the units of the filter in service each day, the number of nozzles cleaned, the dates of cleaning the distributor mains and the underdrains, and similar detail data; the rate at which the filters were operated; and, where used, the amount of recirculation.

Methods of treatment and dates of measures taken for correction of ponding and for *psychoda* control and for other unusual occurrences should be recorded in plant operation data.

Secondary Settling.—From time to time, but most generally in the spring and fall, standard rate trickling filters "unload." High-capacity filters unload continuously. The material accumulated in the interstices of the bed slough off and are washed out by the sewage. It is customary to provide a secondary settling tank for the effluent from the trickling filter bed; the usual period of detention is 1 to 1½ hours for standard-rate and 2 hours for high-capacity filters. Operation of this secondary settling tank does not differ materially from the operation of primary settling tanks.

Disinfection of Sewage

Chlorination of sewage is employed for a number of purposes: 1. To reduce the bacterial content of the plant effluent and thereby make it less of a nuisance and danger to bathing beaches, shellfish beds, etc.; 2. To control or prevent odors; 3. To aid in coagulation when ferrous sulphate or copperas is used as a coagulant; and, 4. To reduce the BOD of the sewage.

Bacterial Reduction.—While it is not possible to kill all the bacteria in sewage by chlorination, the number can be greatly reduced. This does not make water into which chlorinated sewage has been discharged safe to drink, but it does lighten the load on subsequent water purification processes.

For raw or untreated sewage, a probable application is about 20 ppm.; for settled sewage, 10 to 12 ppm.; and for the effluent from a trickling or sand filter, about 5 or 6 ppm.

The required amount of chlorine is best determined by the orthotolidine test which measures the amount of chlorine remaining after a contact period, of about 15 minutes.

Strength of sewage varies considerably throughout the day, being strongest, as a rule, after the middle of the forenoon. Dosages of chlorine should be adjusted for this period; an adjustment of the chlorine application can be made for the reduced and weaker night flows in many cases.

Odor Control.—As sewage decomposes, odors occur. The most common and important agent causing odors is hydrogen sulphide. Chlorine is used both to prevent its formation and to react with it after it has been formed. Control is more effective, as much less chlorine is required for prevention than for neutralization.

The most common method of prevention is to apply the chlorine in the main sewer as far as possible above the treatment plant. Chlorine acts on those organisms in the sewage which decompose the sulphur compounds, and prevents the formation of the hydrogen sulphide. From 3 to 30 ppm. of chlorine may be required; generally 8 to 10 ppm. will effect a marked reduction in odors. In some places odors are noticeable only during the evening. Under such conditions, chlorination may be needed for only a portion of the day.

After the hydrogen sulfide is released, chlorine will combine with it to reduce or prevent odors, but the amount of chlorine required is considerable, and such procedure is rarely economical.

Odors from trickling filters have been reduced in some cases by 3 to 6 ppm. of chlorine.

Courtesy Wallace & Tiernan

● ***THIS sewage plant installation includes two chlorinators and residual recorder.***

BOD Reduction.—When sufficient chlorine is applied to sewage so that there is a residual of 0.2 to 0.5 ppm., there is a reduction in the 5-day BOD. This reduction depends to a considerable extent upon the characteristics of the sewage, but is estimated at from 10 to 25 per cent. That is, if a sample of sewage effluent shows a BOD of 85, chlorination may be expected to effect a reduction to about 70. Each part per million of chlorine absorbed will reduce about 2 ppm. of oxygen demand.

How Chlorine is Used.—Chlorine is employed primarily in the form of liquid chlorine, Cl.; and also in the smaller plants, as calcium hypochlorite. Liquid chlorine is 100% available chlorine. Actually it is a gas, but under pressure it becomes a liquid in which form it is shipped in steel cylinders. The pressure varies with the temperature from 40 to about 150 pounds, being greatest at high temperatures. At 70° F., it is about 85 pounds per sq. in. The cylinders used in small plants contain 100 or 150 pounds of chlorine, but ton and larger containers are available.

Applying Liquid Chlorine.—Liquid chlorine is applied by means of a chlorinator, the function of which is to take the liquid chlorine from the cylinder, measure it, and feed it into the sewage at the desired rate. Application may be in either of two ways: As a gas, or mixed with water to form a solution, which is then added to the sewage.

The solution feed apparatus is used almost exclusively in sewage treatment. A supply of water under some pressure must be available for operating the machine, the amount of water depending upon the size of the chlorinator and the amount of chlorine fed.

Operation of a Chlorinator. — For proper operation, the room in which the chlorinator is kept should be over 50° F. Warm gas entering a colder chlorinator will condense and may cause clogging. Therefore, the chlorinator should not be placed on an outside wall, but should be in a warmer place than the cylinder or the pipe connecting the cylinder and the chlorinator. A radiator, a small stove, or an electric heater may be used. The chlorinator building should be insulated or well protected. When cold is not too intense, an electric light left burning may furnish the required heat.

Chlorine cylinders should be kept on scales and the weight read each day as a check against the amount of chlorine used; or in the case of very small plants, the scales may be read weekly.

The maximum drawoff or discharge from 100 and 150 pound cylinders at 70° F. is approximately 35 pounds per 24 hours. Due to the change from a liquid to a gas, an excessive drop in temperature will occur and if more than 35 pounds are used daily, 2 or more cylinders should be attached or larger containers used.

A reserve supply of chlorine should be kept on hand; also a supply of duplicate parts, including valves, gaskets, etc. But the operator should not attempt major repairs. Whenever possible an entire duplicate chlorinator should be kept on hand for possible emergencies. Ask the manufacturer of your chlorinator for full directions for starting and stopping, and for other details regarding it.

Chlorine leaks are, of course, dangerous since the gas is irritant to the lungs and causes violent coughing. A concentration of 1 part of chlorine in 100,000 can be noticed; 1 part to 50,000 parts of air causes inconvenience; and 1 part in 1000 of air after 5 minutes exposure produces death. Leaks can be located by means of an open bottle of ammonia. Valves, connections and other places that may permit chlorrine to escape are tested with the ammonia bottle. White fumes of ammonium chloride are formed when chlorine combines with ammonia. Special gas masks are desirable for use in case of leaks. Chlorine being heavier than air, ventilation at or near the floor level is desirable.

Metal parts on the chlorinator, or other metal surfaces, may become corroded. To prevent this, these may be painted with a thin coating of gasoline and vaseline. The gasoline evaporates and leaves a light coat of vaseline which is sufficient protection.

Computing Dosages.—When using liquid chlorine, the desired dosage in parts per million times the number of million gallons per day times 8.33 is the number of pounds of chlorine to be fed daily. For in-

stance, to treat 2 mgd. with 6 ppm. of chlorine, 6 x 2 x 8.33 = 100 pounds per day.

If it is desired to vary the amount of chlorine hourly, the number of gallons per hour times the dosage in parts per million times 8.33 indicates the number of pounds per hour. For example, with a dosage of 8 ppm., and a flow of 300,000 gallons per hour, there will be required per hour, 8 x 0.3 x 8.33 = 20 pounds.

Most chlorinator scales read in pounds per 24 hours. For the proper setting, multiply the hourly rate by 24. In the above case, the rate in pounds per 24 hours would be 20 x 24 = 480 pounds.

Records of Operation.—The records covering the application of chlorine should show (1) the volume of sewage chlorinated daily; (2) the rate of application of the chlorine; (3) the residual chlorine present which, if taken daily should be at the same hour every day; (4) the weight each day, at the same hour, of the chlorine tanks; and (5), new cylinders placed on the scales and their weight.

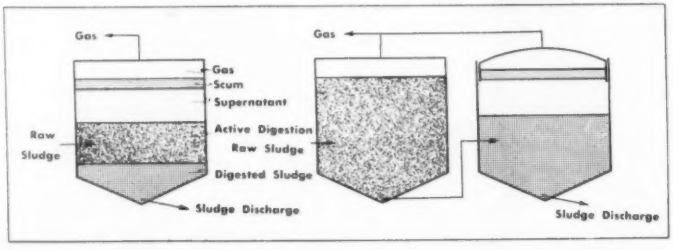
Sludge Digestion Tanks

The disposal of sludge that is deposited in the bottom of sedimentation tanks is one of the serious problems in the operation of a sewage treatment plant. This material is highly decomposable and offensive. Generally the best method of treatment is by digestion. In this, the sludge is stored in deep tanks for 30 to 50 days or longer, during which time the organic matter is digested and converted into more stable forms. After this digestion process, the sludge can be dried on sand beds without nuisance.

Moisture Content.—The solid materials in raw sludge as drawn from settling tanks does not ordinarily exceed 4% or 5%, the remainder being water; and in very thin sludge, there may be only 1% or 2% of solids. Where the solid content is only 1%, there are 99 volumes of water for each one volume of solid material; where it is 2%, there are 49 volumes of water for each: and where it is 4%, there are 24 volumes of water. Thus a sludge with 1% of solids is, for the same volume of solids, about four times as great in volume as a sludge that has 4% of solids.

Amount of Sludge.—The moisture content has such a bearing on the volume of sludge that it is impossible to make a statement as to the volume of sludge to be expected. The only basis on which to make a comparison is that of the amount of dry solids, which is secured by evaporating the sludge to a dry condition. The usual sewage treatment plant will remove from 100 to 300 pounds of dry solids per 1000 population or 1/10 to 2/10 pounds per person per day. The actual amount of sludge varies from 2500 to 10,000 or more gallons per million gallons of sewage.

Sludge digests rapidly at a temperature of 80° to 95° F. Sewage is much cooler than this—usually varying, during the year, from 45° F. to 70° F. Therefore in most tanks it is desirable and economical to heat the sludge, since digestion is more rapid and a smaller tank can be used—2 to 3 cu. ft. per person is probably enough for a heated tank in a primary treatment plant, but at least 4 cu. ft .per person is necessary for an unheated one, except in warm climates. In both cases, more space will be required if secondary treatment is provided. Heating is usually accomplished by means of hot water pipes placed inside of the tank, or by a special outside heater, burning the gas that is formed during the digestion of the sludge. This gas, which is about 65% methane has a heat value of around 650 btu per cubic foot or about the same as ordinary cooking gas. About 1 cu. ft. per person per day is produced on an average.



● ***DIAGRAMMATIC sketch shows, for single and two-stage digestion tanks, the layers into which tank contents tend to separate.***

Operation Details.—Sludge should be added to the digester on a regular schedule and in as small increments as possible, since a heavy load of fresh solids may interfere with digestion. Sludge should be completely removed from the settling tanks, but excess sewage should not be drawn. It is not generally possible to store or hold sludge in the settling tanks; the digestion tanks must be capable of taking all the sludge that is produced every day without being overloaded.

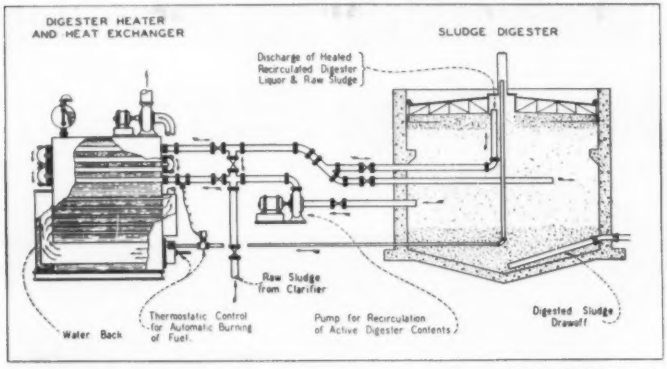
Where digesters are equipped with mixers they should be operated in accordance with the manufacturer's instructions. Where there are facilities for recirculating by pumping, some operators prefer to use these facilities for promoting digestion, breaking down scum, mixing lime with the sludge for pH value adjustment, etc. Where no facilities for mixing or recirculating sludge are provided, the operator must rely upon natural mixing of the raw and digested sludge in the digestion unit.

The hot water pumped into the heating coils of the tank is generally maintained at a temperature of 120° F. to 130° F. A temperature much above 140° may bake the sludge on the outside of the pipes and cause loss of heat conductivity. The contents of the tank are usually kept at 80° F .to 95° F. Thermometers record the temperature of hot water and of the cooler return water; also of the temperature of the digesting sludge.

Sludge is removed when it is fully digested. Most digesters are provided with devices for sampling the sludge, so that only fully-digested sludge need ordinarily be drawn. Too much sludge should not be removed at one time. To do this may rob the tank of the "ripe" sludge and leave an insufficient amount to mix with the fresh sludge added every day. Ordinarily, when sludge is drawn, the sludge drying bed unit is filled to capacity. This is necessary because the number of drying beds available is usually limited and each must be worked nearly to capacity. When drawing the sludge, the operator should watch the sludge and cease drawing it whenever any change in appearance is noted that indicates improperly digested sludge. Generally not over 10% of the ca-

pacity of the digester should be drawn at one time.

Frequent pH tests of the sludge should be made. This is not easy with ordinary pH apparatus, and electrical pH apparatus is recommended. If the color test method is used, the sludge should be centrifuged, which is not always satisfactory; filtered, which gives somewhat high pH results; or diluted with distilled water, allowed to stand and the pH taken on a clear portion. Sludge digestion proceeds most favorably at pH values of 7.0 to 7.6—preferably above 7.2, but some plants report good results with pH



Courtesy Pacific Flush Tank Co.

● ***A METHOD of arranging external digester heating units and recirculating pump.***

readings of 6.8. The alkalinity of the supernatant or the sludge, which may run from 1500 to 3500 ppm. also affords an excellent check on operation.

If the pH value is below 7.0, t is usually desirable to try to raise it. This is most frequently done by adding lime to the sludge as it enters the digester. It is almost impossible to determine, except on the basis of past experience, how much lime should be added. The alkalinity of the supernatant is a help on this. A start might be made using ¼ to ½ pound per cubic foot of sludge, and more added if the pH value or alkalinity does not rise appreciably in a few days. This can be added at the sludge pump, or in the recirculation pump if there is one, as recirculation is helpful in mixing.

In many plants, the first year of operation of a digestion tank is a troublesome one. The operator should secure detailed directions from the designing engineer or the manufacturer of the equipment installed in the digester, and should follow these instructions, calling for further help as needed.

Operating Difficulties. — Foaming may be due to acid sludge; to the addition of too much raw sludge t one time; to industrial wastes (as creamery, slaughterhouse, etc.); to too rapid digestion (as may occur in unheated tanks with the advent of hot weather); and to unknown other reasons. A frothy, objectionable material rises to the top of the tank and may even overflow, filling pipes and gas traps. If possible to dispose of it otherwise, do not add raw sludge for several days, and then only in small amounts. If the sludge is acid, try to bring it above the neutral point by adding lime or other material. Draw some sludge to reduce the level in the tank, but not too much, as this may rob the tank of the ripe sludge needed for digestion. If the trouble appears to be due to industrial wastes, try to correct these by pretreatment at the industry or at the treatment plant. If foaming is due to cold conditions in the winter, it may be preferable to empty the tank, store the sludge in a lagoon, and start using the tank again when the weather is warm.

In areas where the water contains considerable mineral matter in the form of sulphates, decomposition of these may take place in the digester with the production of hydrogen sulphide. If the tank is a closed one, and the gas is burned, there will be no odor; but the resulting acid may corrode meters, flame traps and perhaps piping. This is prevented by neutralizing the H_2S by passing the gas through iron oxide or other scrubbers; or by maintaining the gas at a high enough temperature to eliminate moisture in it, thus preventing the formation of the acid which is the corroding agent. It is well to consult with the manufacturer of the digester equipment.

Utilizing the Gas.—The gas from digesters is commonly used for heating the sludge in the digester; in the plant laboratory; for heating the plant buildings; and for operating gas engines to drive pumps, when pumping is needed. This gas is explosive and equipment for handling it and utilizing it should be furnished and installed only by a manufacturer specializing in this work, and not by plumbers; nor should it be homemade.

Supernatant Liquor.—The overflow from the digestion tank, or supernatant, frequently offers a problem in disposal, since both its solids content and its BOD are very high. It is rather common practice to run or pump this back into the inlet of the sedimentation tank. In some plants this method of disposal is satisfactory; in others it appears to affect adversely the quality of the effluent. Probably the strength of the supernatant, the capacity of the digester and the characteristics of the sewage are factors.

The supernatant amounts, in volume, roughly to the sludge pumped from the settling tank less that drawn onto the drying beds. Attempts have been made to treat the supernatant on sand beds; it can be coagulated by the addition of about 250 ppm. of aluminum sulphate followed by a short period of settling —about 15 minutes. There is no established satisfactory method of disposal. If the supernatant appears to interfere with proper operation of the settling tank, treatment on sand beds may be tried with the advice of your state sanitary engineer. If the supernatant appears to be of unusually bad quality, ask for advice from the engineer or the manufacturer of the digester apparatus, as the difficulty may lie in faulty operation of the digester.

Operating Records.—If sludge is pumped from the settling tanks to the digestion tanks a record of the hours of pumping and of the pump capacity should be kept; it is very desirable to know how much sludge, in gallons or cubic feet, is added to the digester daily. The temperature of the sludge in the digesters should be recorded daily or weekly; also the pH value of the sludge. The dates on which sludge is drawn should be recorded, and also the amount of sludge drawn. Frequent tests should be run to determine the per cent of dry solids in the sludge as removed from the digester. Other

desirable information includes total solids and volatile solids in the digested sludge and the BOD of the supernatant. A record of the daily gas production from the digester should be made from the gas meter; also of water temperatures in the heating water.

The Disposal of Sludge

THE sludge drawn from a sludge digestion tank or from the sludge compartment of an Imhoff tank contains only a small percentage of solids—usually from 4% to 10%. The excess water must be removed. This is normally done on a sand bed, preferably covered with glass, or by means of vacuum filters.

If the moisture content of the sludge can be reduced to 65% or 75% the sludge can be used as a fertilizer for parks, grass plots, farms, etc., or it can be piled up in heaps, or burned in an incinerator. It should be noted that sludge with 5% solids and 95% water is six times as bulky for the same volume of solids as sludge containing 30% solids and 70% moisture.

After it has been properly digested, sludge has little disagreeable odor and when properly dried or dewatered thereafter is unobjectionable. The removal of the excess water is necessary to facilitate final disposal.

Sludge Beds.—A sludge drying bed consists of a layer of 6 to 12 inches of sand, supported on 6 to 12 inches of graded gravel, under which are placed open joint drains. The water drains out of the sludge, and evaporates from it also—both actions being important. That part of the moisture which drains out passes down through the sand and gravel and into the underdrains which may discharge after chlorination into the outlet sewer from the plant; or into a pump sump from which it is returned to the sedimentation tank. The latter procedure is preferable.

Sludge drying beds may be either open or covered. Structures similar to greenhouses are generally used for covering the beds. The open or uncovered beds should generally provide 1½ square feet of area for each person served by the plant. That is, for 10,000 persons contributing to the sewers there should be 15,000 square feet. Covered beds need be only two-thirds as large. The covered beds are more effective because they keep off rain and also the temperatures inside of them are normally higher, resulting in greater evaporation. Ventilators should normally be kept open to aid in ventilation.

Depth of Sludge on Beds.—The depth to which wet sludge should be placed on the beds depends upon the condition or quality of the sludge primarily. The average depth in usual practice is 8 to 12 inches of wet sludge. With well digested, quick-drying sludge, greater depth is permissible. There is, in most plants, a critical depth at which best drying is accomplished, and the operator should learn this as soon as possible. If a 10-in. drawing will dry in 10 days, and a 12-in. drawing in 14 days, the former is best.

A well digested sludge is perhaps the most important item in sludge bed operation, so that control of digestion tank operation affects materially sludge bed operation.

Care of Beds.—After each layer of dried sludge has been removed, the bed should be raked and leveled. Some beds slope from the sludge discharge pipe to the far end, frequently at about 6 inches in 100 ft. However, the amount of slope that is desirable varies with the character of the sludge. Imhoff tank sludge is often thicker than sludge from a digestion tank. The operator can determine this for his plant.

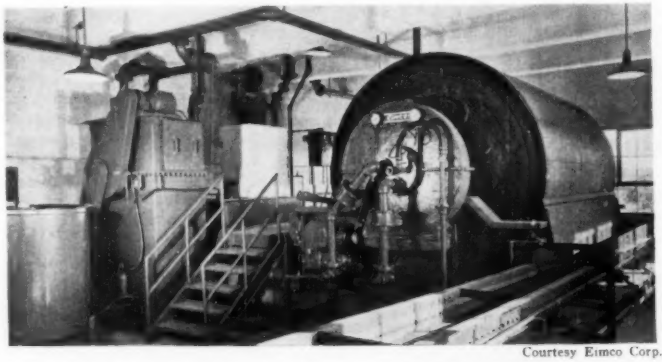
Wet sludge should never be discharged on a bed containing dry or partially dried sludge. Such material should be removed before another application of sludge.

When plenty of drying bed space is available, the sludge may be left until it is quite dry. In most plants excess area is not available and the sludge can be, and perhaps must be, removed as soon as it is dry enough to handle with a fork. It is preferable to remove the sludge at least a day or two before it is planned to apply more, to give the surface of the sand time to dry. Drying of sludge can be expedited by the use of chemicals.

Removing Sludge From Beds.—A fork with 6 or more tines is generally used for removing the dried sludge from the surface of the beds. As little as possible of the sand should be removed with the sludge, but some will always stick to the sludge, so that there is a loss of sand with each layer of sludge removed. This requires eventual replacement of the sand. When the sand layer is reduced to 4 to 6 inches in thickness, more sand should be added. Occasionally the top layer of sand becomes clogged and interferes with drainage. When it is noted that the sludge dries slowly, the sand should be examined and if it appears to be clogged with organic matter, the top 2 or 3 inches should be removed and replaced with clean coarse sand.

Beds are provided with overhead rails or other devices for handling the sludge. On small beds, after the sludge near the door has been removed, a runway of planks can be placed on the sand and a light truck backed in on the bed. Sludge can then be loaded direct into the truck. To avoid breaking the underdrains, a double layer of planks, at right angles to each other can be used. A front end loader can be used. With the bucket lowered, it is easy to fill it with sludge. When full, the tractor removes the load.

Disposing of Sludge.—Sludge has fertilizer value and in some cases farmers will haul it away, but they will rarely pay for the sludge itself. In some cities, the park department uses the sludge on grass and shrubs. For such use, the sludge generally should be ground, as the lumps in unground sludge take some time to break up. Some of the sludge pro-



Courtesy Eimco Corp.

● ***VACUUM sludge filter installed at the Battle Creek, Mich., plant.***

duced can be used around the treatment plant for fertilizing grassy areas and shrubs. This is the best method of advertising both the value of the sludge and the quality of operation of the plant.

Using Chemicals.—Various chemicals have the property of expediting the drying of the sludge through improving its drainability. These are especially valuable where there is a lack of bed area. The ones principally used for this purpose are ferric chloride and aluminum sulphate. Ordinary applications are 5% or 6% by weight of the dry solids in the sludge. Computations for determining the amount of chemical needed are as follows: Assume a bed 20 ft. by 20 ft. to be covered with 12 inches of sludge having 2% solids and 98% water. Assume the weight of sludge the same as water, or 8.3 pounds per gallon or 62.5 lbs. per cubic foot.

A bed 20 x 20 contains 400 sq. ft.; and when 12 ins. of sludge is drawn contains 400 cubic feet of sludge. At 62.5 pounds per cubic foot, this sludge weighs 25,000 pounds. If 2% of the sludge is solid matter, the weight of solid matter is 2% of 25,000 or 500 pounds. If 5% of the chemical is to be applied, the amount required would be 500 x .05 = 25 pounds.

The chemicals are usually added as a solution just as the sludge is flowing onto the bed, as the reaction is rapid.

Winter Operation. — Beds offer some difficulties in winter operations, particularly when heavy ice or snow storms, followed by freezing weather, occur after the sludge is partially dried on open beds. However, sludge may be placed on beds, particularly covered beds, in freezing weather. If frozen sludge can be removed without taking too much sand, and stockpiled, it will be found very desirable for use on lawns, after thawing and drying, as it tends to powder easily.

It is particularly important that all sludge lines (as well as any other lines carrying liquids) should be drained completely to prevent sludge from hardening in them, and also to prevent freezing in the winter.

Records of Operation.—At the time the sewage is drawn a record should be made of the date, the number or designation of the bed onto which the sludge is drawn, the depth of the wet sludge and the number of cubic feet drawn. When the sludge is removed from the bed, the date and number of the bed being cleaned should be shown; the depth of the dried sludge, the length of time it has dried and the number of cubic feet or cubic yards removed; also the man hours and truck hours required for removal. When the sludge is drawn to the beds, an examination to show the solids content, the volatile solids and the pH should be made. Likewise the moisture content of the dried sludge should be determined. All these factors should be noted on the records of operation.

Vacuum Filters.—Vacuum filters are used for rapid dewatering of sludges. They are suitable for either raw or digested sludges from primary or secondary treatment plants. Sludges containing 85 to 98% moisture are rapidly dewatered, producing a filter cake with 65 to 75% moisture. These filters are especially worthy of consideration in these days of high labor costs. Filtering is accomplished through a cloth or coil spring medium on a drum rotating in a container of sludge. The filter cake is removed by air pressure and a scraper onto a conveyor.

When sludge is properly conditioned, yields of 4 to 5 pounds of dry solids per sq. ft. of filter per hour are obtained while dewatering plain settled and chemically precipitated sludges, in either raw or digested condition. Chemicals required for most efficient and economical operation for such sludges may range to 5% of ferric chloride and 10% or less of lime, figured on the dry solids in the sludge. The moisture of vacuum filter cake will average from 65 to 70%. The operator must determine by trial the chemical dose most suited to the sludge with which he is working.

In order to be sure that the sludge is properly conditioned, it is better when starting filtration to increase the chemical dose somewhat above the normal for about a half hour and then gradually reduce the dose to a normal amount, until just the right cake is being obtained. When the proper chemical dose is obtained, the cake will be discharged cleanly without sticking.

In small plants with adequate vacuum filter capacity, sludge dewatering may require only a part of a day two or three times a week. One man can operate a filter. If a conveyor is used, discharging into a truck, handling of the sludge is entirely eliminated.

Maintenance of Equipment

Metering Devices. — Weirs and float wells must be cleaned daily to prevent the accumulation of solids and grease. Weir plates should be maintained sharp and straight.

When dosing chambers are used for flow measurement, particular attention must be paid to keeping these free from accumulations of solids. Parshall flumes must be kept free from grease and adhering scum and the float well flushed frequently. Venturi tubes should be cleaned 2 or 3 times a week.

Float gauges should be checked monthly by lowering the liquid elevation to the crest level, at which time the pointer should be on the 0 mark. If it is not, the calibrated portion of the gage should be adjusted. Indicating, recording and integrating flow instruments should be checked by dropping the liquid to the crest (on Parshall flumes) or by equalizing the liquid level or pressure in float tubes or chambers in the case of Venturi tubes. Unless the operator is experienced in this work, he should ask the manufacturer for instructions.

Charts should be changed at the same time every day. Records maintained should show total flow, the maximum rate of flow and the minimum rate of flow, all in m.g.d.

Sludge Pumps.—Sticks, rags or other solid objects may clog the valves of reciprocating sludge pumps, holding them open. On pumps which have a pressure gauge on the discharge side of the pump, the fluctuations of the gauge needle provides a good indication of the operation of the pump. No fluctuation indicates that the inlet valve is being held open; a greater than normal fluctuation indicates the discharge valve is not seating. Quick-opening hand-holes are provided through which obstructions are removed. The pump and the area around it should be kept clean. Air should be kept in the air bell. Operating, lubricating and maintenance instructions provided by the manufacturer should be followed.

Sewage Pumping Stations.—Centrifugal pumps are used almost exclusively in pumping sewage, normally operating at speeds of around 1150 rpm. Pumps are set (1) submerged in the sewage in a wet well; (2) in a dry well below the sewage level in an adjoining sump or well; or (3) above the sewage level and raising the sewage by a short suction line. The second method is generally preferable.

Since the cost of pumping, where this is necessary, is usually a large item in the cost of operating the plant, special attention should be given to maintaining the pumps in an efficient operating condition. Pumps that are partly clogged, have inlets that develop excessive friction or entrance losses, or have worn or improperly designed impellers may contribute to excessive power charges. Improperly maintained pumps may fail, which in a sewage plant is almost always a major disaster and may create a health hazard.

Wet wells should be drawn to the minimum elevation daily, and (1) deposits removed; and (2) walls and bottom thoroughly flushed with a heavy stream of water. Grit accumulations should be removed at regular intervals. Grease accumulations in float tubes should be removed daily by flushing or other means. Screens should be cleaned daily or oftener, as indicated by the amount of screenings accumulated, and these should be carefully disposed of as already indicated. Water that accumulates in the dry well should be removed daily.

The pumping cycle is normally controlled by floats and sequence switches. Where pumps of different capacity are installed, the smaller pump should cut out when the larger one starts (and vice versa); both should operate only under peak loads. Where there are 2 or more pumps of the same size, they should be alternated to provide equal wear. Standby pumps should be operated

once each week for a short period to insure they are in proper condition and to dry out motor windings.

All bearings, motors and electrical control equipment should be inspected daily for overheating. The manufacturer's directions for operation and equipment lubrication should be studied and followed carefully. Packing glands should also be inspected daily. Excessive tightness should be avoided, a packing being too tight when the shaft cannot be rotated by hand. Use the packing recommended by the manufacturer of the pump.

Operation of the pump briefly in reverse is sometimes effective in preventing clogging, as this tends to free material caught in the impeller. A reversing switch must be installed on the control board to permit this. Operation in reverse should not exceed one or two minutes.

Other Factors

Safety in the Sewage Plant.—Some of the precautions to be taken in regard to liquid chlorine have already been mentioned. Gas poisoning and gas explosions are other hazards. The gas produced by sludge digesters is explosive when mixed with certain proportions of air. Therefore smoking or carrying open flames in or around digesters is hazardous. In pump pits or other covered and enclosed places explosive gas may gather and precautions are necessary in entering them to prevent explosions. Also, the gases contained may be fatal to anyone who breathes them. Therefore covered tanks or pits should be well ventilated by blowing air through them before being entered; anyone entering them should fasten a rope to his body, and another man should remain outside holding the other end of the rope and ready to help.

A first aid kit and a gas mask should be a part of the equipment of every plant. Be sure to note if this mask protects against chlorine and against carbon monoxide also. Individual gas masks are serviceable for protection against only a few gases. Therefore a mask designed to serve against ammonia may be or no use whatever against other gases.

It is desirable to protect tanks by railings to prevent attendants or visitors from falling into them. Gears and other moving parts should be screened or guarded.

Keep a set of the blueprints showing details of the plant. Some of these may be framed and hung on the walls, not so much for decoration as for ready reference and preservation. Prints handled frequently rapidly wear out. Pumping installations, pipe layouts, and similar material that is needed for more or less frequent reference can be kept under glass.

Keep your own copy of your monthly reports to the State Department of Health, and study them from time to time. Familiarity with what has been done and the results obtained is of most value in efficient operation. Written records are best, as memory is sometimes unreliable.

Plant beautification should not be neglected. Plant shrubs, flowers and grass and keep the grounds clean, neatly mowed and trim.

A library should be maintained at every plant. This should include *Standard Methods* and at least a couple of recent texts on sewage treatment; also some of the many excellent bulletins and pamphlets issued by manufacturers serving this field. Read your technical magazines; the Sewerage Digest section of PUBLIC WORKS will keep you informed on what has been published. Join your Sewage and Industrial Wastes Works Association, or at least attend its meetings. Enroll for some of the short courses for plant operators now being given in almost every state.

Refuse Collection and Disposal

(Continued from page 35)

the slight decrease in the reported use of open or partly covered dumps and of feeding to hogs. Health authorities have done but little to control these methods of disposal, if they can be so termed; more, it appears, has been accomplished by education on the part of manufacturers of equipment to be used in sanitary fill operation. The same is true, but to a lesser extent, of the use of garbage grinders, though this method appears to have increased somewhat.

Incineration was reported by 14.7% of the cities in 1940, and by 12.4% in 1950. This variation is probably so near the possible error of sampling that it is difficult to determine if these figures represent a definite trend. However, the 1950 survey covered approximately one-third of the cities of more than 4,-vey covered about one-half, so the sampling in either case should be fully representative.

TABLE 6—METHODS OF DISPOSAL

	1950 All	1940 Large	1940 Small
Incineration	12.4%	14.7%	4.8%
Into Sewers	1.1%	0.7%	——
Sanitary Fill	21.4%	11.3%	6.8%
Dumps	33.4%	37.0%	56.8%
Hog Feeding	31.7%	36.2%	31.6%

Note: Sanitary fill includes "burial" for 1940; "Dumps" include both open and partly covered.

Disposal of garbage into sewers increased slightly from 0.7% in 1940 to 1.1% in 1950.

Plans for the future were reported by 125 cities, of which 63 contemplate sanitary fill; 52 plan new or larger incinerators; and 10 intend using other methods, as disposal into sewers or composting.

Wastes Disposal in Texas

In a paper before the Annual Texas Water and Sewage Works Short School last March, G. R. Herzik, Jr., Chf. Engr., Bureau of Sanitary Engineering, Texas State Dept. of Health, gave some interesting facts concerning the disposal of liquid wastes in that state. He knew of 64 towns utilizing land irrigation as a method of domestic sewage disposal. Most of these operate their own farms, but some give or sell the water to nearby farmers. Usually feed crops are grown on these farms and, from reports, bountiful harvests are realized and considerable profits obtained. Land application of industrial wastes might be limited because of the large volumes and because many wastes are detrimental, not only to crops but to the soil as well.

Some 32 additional cities employ sewage lagoons. These are ponds about 3 ft. deep, designed for surface areas meeting certain pre-determined biological loadings. These are producing very acceptable effluents. They should prove satisfactory for certain types of industrial wastes; and the effluents, after proper treatment might be re-used as process water by the industry.

Evaporation ponds are subject to too many variable weather factors to justify consideration of them as a reliable method of waste disposal, although in most sections of Texas the average annual evaporation rate exceeds the average annual rainfall. However, artificial evaporation has been used successfully in several instances, and lends itself very admirably to usage in areas where natural gas is wasted or is very inexpensive.

When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

ADVANCE PLANNING FOR Public Works

HARRY HEWES

WHEN the 1,049 projects, for which interest-free advances already have been approved for engineering studies and plan preparation in the Housing and Home Finance Agency's second Advance Planning Program for non-Federal public works, are built or installed they will cost, at 1950 prices, an estimated $636,242,000. Repayable funds approved for planning assistance total $18,703,388.

Under review in HHFA's Community Facilities Service which administers the planning program there were in September additional applications for planning funds to bring 745 public works to cost an estimated $797,567,570 through blueprint and specification stages. For assistance in this planning the applicants—cities, towns, counties, college boards and school and sanitary districts—asked $19,803,974.

The figures are in a report from CFS Commissioner Pere F. Seward to HHFA Administrator Raymond M. Foley. Community Facilities Service was transferred on May 24 to the Housing Agency from the General Services Administration under the President's Reorganization Plan No. 17. As an integral unit of the former Federal Works Agency, CFS had administered the first Advance Planning Program, June 1945-June 1947, during which non-interest bearing funds had been advanced for the planning of 6,917 public works projects, most of which have been placed under construction. In both programs the advance funds are to be returned into the United States Treasury when building operations are started.

Proposed Public Works For Which Advances Have Been Approved

Type of Work	Applications	Estimated Cost	Advance Approved
Highways, roads, & streets	49	$14,716,250	$497,298
Bridges, viaducts, & grade sep'ns.	30	19,125,880	595,860
Airports	4	4,766,710	125,280
Sewer facilities	394	256,655,115	6,942,797
Water facilities	125	42,606,428	1,403,139
Sanitary facilities	11	3,991,512	162,960
Schools & other educational fac.	324	168,858,033	5,644,034
Hospitals & health fac.	13	19,048,155	467,040
Other public buildings	53	68,874,327	1,991,260
Parks & other recreational fac.	29	9,298,521	294,480
Miscellaneous public fac. (nec)	17	28,301,149	579,240

Projects for sewers and sewage works lead in number in the second Advance Planning Program, as shown in the accompanying table.

Location	Type	Estimated Cost	Planning Advance
Alabama			
Streets and Bridges			
Birmingham	Grade separation structure	$ 2,560,000	$ 99,000
Fort Payne	Street improvements	174,955	6,480
Mobile	6.65 miles of 4-lane divided highway	4,000,000	190,000
Luverne	Street improvements	131,800	4,500
Shelby County	Coosa River highway bridge	622,500	27,300
Water Works			
Enterprise	Well, pumping station, reservoir; 35,200 ft. CI pipe	237,510	9,760
Harpersville	Supply, storage and distribution mains	32,000	1,660
Oakman	Supply, storage and mains	74,000	3,900
Tuscaloosa	Dam and reservoir, 6 m. 36" CI mains, tunnels	1,351,961	50,860
Sewers and Sewage Treatment			
Columbiana	Collection and outfall lines; treatment	60,000	3,000
Fort Payne	Extensions	180,000	6,540
Alaska			
Water Works			
Haines	Extension of water system; new sewage system	145,100	9,500
Hoonah	Additional water supply and storage	46,160	2,400
Seldovia	Waterworks improvements	52,200	3,500
Arizona			
Streets			
Casa Grande	Grading, 60,000 ft. curbs and gutters, 87,500 ft. sidewalks	$ 340,500	$ 18,200
South Tucson	Widening, paving, curbs and sidewalks	415,692	16,800
Winslow	Paving curbs, gutters	49,999	2,300
Sewer projects			
Casa Grande	Extensions	21,000	1,000
Winslow	Extensions	26,359	1,160
Arkansas			
Water Works			
Eudora	System extensions; new treatment plant	100,000	4,340
Gurdon	Waterworks improvements; new supply	72,000	2,940
Huntington	Complete system	61,491	2,580
Sewers and Sewage Treatment			
Eudora	Extensions, outfall; treatment plant	155,000	6,360
Fordyce	Improvements; treatment plant	274,000	7,600
Gillett	New system and treatment plant	46,950	1,500
Gurdon	New lines; treatment plant	113,582	4,680
Hamburg	Renovations and additions	88,000	4,200
Mississippi Co.	Cleaning 88 miles of ditches; 52 miles new ditches	642,900	20,680
Pocahontas	Additions and extensions	227,702	9,100
Rogers	Extensions; treatment plant rehabilitation	303,633	11,880
Sparkman	New system; treatment plant	75,000	2,500

Location	Type	Estimated Cost	Planning Advance
California			
Streets, Bridges and Viaducts			
Auburn	Street widening and alignment	$ 49,330	$ 1,240
Culver City	Widening 2 streets	67,760	4,220
Oakland	Railroad underpass	540,124	20,000
Oakland	Grading, paving, underpass, bridge	837,873	23,800
San Diego	Bridge	1,196,000	28,500
San Diego	Bridge	1,090,000	29,000
Willits	Street improvements	268,080	19,600
Water Works			
Napa-Solano Cos.	7 miles of 21 in.-28 in. pipe	471,827	15,760
Vallejo	Treatment plant	1,438,727	89,860
Sewers and Sewage Treatment			
Costa Mesa	Additions and lift pump	264,247	12,000
Hayward	Sewage; additions; treatment plants	1,117,000	54,000
Isleton	Intercepting sewers; treatment plant	172,482	12,200
Menlo Park	Storm drainage system	163,100	6,660
Millbrae	Treatment plant and force main	447,500	10,000
Orange Co.	63,800 ft. trunk sewer, pumping sta.	2,618,078	96,660
Orange Co.	70,000 ft. sewers; 5,200 ft. CI force main for Midway City Sanitary District to trunk of Joint Orange Co. Outfall System	322,000	15,000
Porterville	Outfall sewer; treatment plant	495,000	15,000
San Rafael	Storm sewers with pumps or gates	109,000	5,000
St. Helena	Trunk line; treatment plant	90,230	4,700
Colorado			
Water Works			
Adams County	Transmission and distribution mains	148,886	4,500
Golden	Treatment plant and pumping station	208,860	11,380
Sewers and Sewage Treatment			
Evergreen	New system and treatment plant	162,900	7,100
Louisville	New system and treatment plant	156,300	7,500
Connecticut			
Refuse Disposal			
Hartford	Garbage and refuse incinerator	1,000,000	45,000
Water Works			
New Britain	30,000 lineal feet supply main	750,000	22,800
Sewers and Sewage Treatment			
Groton	Treatment plant	395,230	22,000
New London	Additions, pumping & force mains	390,000	2,740
Pawcatuck	Treatment plant	118,900	6,200
Pawcatuck	Sewer system for 3 areas	428,700	16,400
Plymouth	Collection system	507,600	18,500
Plymouth	Treatment plant	162,500	6,200
Portland	Treatment plant	107,548	6,200
Seymour	New system and treatment plant	750,000	22,500
Delaware			
Sewers and Sewage Treatment			
New Castle Co.	Collection system; interceptor; pumping station	1,874,600	74,100
Florida			
Streets, Bridges and Drainage			
De Funiak Spring	Paving curbs, gutters; storm drainage	136,750	7,500
Fort Walton	(2 units) paving, storm drainage	209,000	11,280
Jacksonville	River front improvements	2,435,100	30,000
North Miami Beach	Street paving and bridges	673,680	16,900
Water Works			
Hialeah	Waterworks system additions	$ 395,000	$ 17,500
Sewers and Sewage Treatment			
Gainesville	Extensions; treatment plant	1,368,300	37,750
Havana	Additions; treatment plant	117,000	6,380
Miami	Sanitary sewer system extensions	6,493,355	60,000
Miami	500,000 lineal feet storm sewer	3,467,000	75,000
Orlando	(2 units) sanitary sewer system exten.	547,300	26,500
Georgia			
Water Works			
Colbert	Waterworks system	53,260	1,560
Griffin	9-mile 20 in. supply main, pumping, treatment	1,225,000	35,000
Sewers and Sewage Treatment			
Griffin	Collection system; treatment plant	821,790	22,000
Savannah	171,000 ft. of sewers; 7 lift stations	1,997,400	65,380
Idaho			
Streets			
Alameda	Paving	142,150	4,400
Water Works			
Kimberly	System improvements	40,000	1,200
Mountain Home	Improvements	77,100	3,200
Sewers and Sewage Treatment			
Blackfoot	Additions and improvements	251,000	8,800
Coeur d'alene	Storm sewer additions	215,000	7,500
Idaho Falls	Interceptor sewer	636,100	11,140
Marsing	Collection system and treatment plant	105,462	5,200
Mountain Home	Improvements and additions	44,200	1,800
Nampa	20,000 ft. 24 in.-30 in. intercepton, 55,000 ft. of laterals	500,000	12,000
Illinois			
Streets			
Evanston	Grade separation	346,000	14,500
Johnston City	Pavement, curbs, gutters, storm sewers	252,836	9,220
Roanoke	116,067 square feet of new sidewalks	52,262	1,740
Utilities			
Bloomington	Improving municipal electric plant	3,816,000	117,000
Centralia	Municipal airport	100,000	3,900
Kankakee	Incinerator	395,800	13,600
Water Works			
Arlington Hts.	Ground level storage, pumping, mains	295,000	7,000
Bloomington	Enlarging filtration plant, reservoir, mains, elevated storage	1,123,600	34,400
Columbia	Water survey and feeder mains	144,000	8,400
Jerseyville	New supply, pumping, treatment, storage	540,000	19,660
Mt. Prospect	Storage, pumping station and mains	160,000	4,940
Petersburg	Extensions; elevated storage tank	157,215	6,460
Sewers and Sewage Treatment			
Alorton	Storm drainage system	213,000	8,000
Alpha	Pumping, treatment	51,000	1,800
Arlington Hts.	15,000 ft. 24 in. to 36 in. sewers	756,000	24,000
Bridgeport	Additions to system, treatment plant	238,409	8,780
Casey	Extensions	295,970	10,860
Decatur	1—intercepting and relief sewers, pumping station	1,059,000	30,000
Decatur	2—intercepting and relief sewers, pumping station	1,941,000	55,200
East Dubuque	Extensions; treatment plant	61,979	3,420
East Moline	Storm sewers	704,000	22,940

Location	Type	Estimated Cost	Planning Advance
Elburn	New system and treatment plant	$ 157,611	$ 5,000
Galena	Extensions	229,400	6,980
Golconda	New system and treatment plant	146,894	5,360
Kankakee	1—Survey and report on treatment	132,600	7,000
Kankakee	2—Sewers in Sunnyside District	178,500	6,280
Mt. Carmel	New lines and treatment plant	503,300	17,400
Mt. Pulaski	New system and treatment plant	225,000	12,760
Nashville	Industrial waste treatment facilities	53,000	2,180
Oak Lawn	Storm sewers and realignment of creek	576,906	15,700
Ottawa	40,000 ft. 8 in. to 24 in. sewers, 5 pumping stations, 14,000 ft. 10 in to 72 in. storm relief sewers	2,149,200	74,360
Princeton	Improvements and extensions	112,240	3,120
Rockton	New system and treatment plant	221,485	11,400
Round Lake	New Mains, pumping station	49,972	1,920
Sangamon Co.	(10 units) sanitary sewer system exten.	4,487,000	131,500
Shabbona	Improvements; treatment plant	72,200	3,000
Sheldon	Relief storm sewers	100,000	4,000
Springfield	Sanitary and storm sewer extensions	120,000	3,640
Waukegan	Improvements	560,000	20,000

Indiana

Streets

Bluffton	Paving	48,650	2,140

Airports

Newcastle	Airport	248,460	10,580

Water Works

Arcadia	Additional well, softening, main extensions	65,100	2,400
Bluffton	New Mains	47,970	2,100

Sewers and Sewage Treatment

Beech Grove	Sewers, pumping, enlarging treatment plant	475,000	15,800
Bloomfield	Extensions; treatment plant renovations	141,723	5,280
Bluffton	Sanitary and storm sewer extensions	89,940	3,940
Boonville	Interceptor sewers; treatment plant	340,000	11,200
Clarksville	Pumping stations, force mains and treatment plant	649,928	24,420
Covington	Extensions; treatment plant	194,000	6,580
Evansville	(1st of 3 units) Intercepting sewers; and treatment for East Side	3,500,000	92,000
Gas City	Storm relief sewers; treatment plant	250,000	10,900
Greenwood	Intercepting sewers; treatment plant	322,500	12,000
Indianapolis	Intercepting and relief sewers	2,111,000	61,500
Jeffersonville	Extensions; treatment plant	1,394,792	39,520
Lapel	New system and treatment plant	165,600	6,000
Loogootee	New system and treatment plant	271,565	10,280
Milan	Additions; treatment plant improvements	120,000	3,920
Muncie	Extensions	2,241,205	67,600
New Haven	Intercepting sewers	80,000	2,260
Sellersburg	Pumping, force main and treatment	100,000	3,600
Shoals	New sewer system and treatment plant	110,109	3,980
Sullivan	Additions and improvements	259,000	8,700
Terre Haute	Intercepting sewers; pumping station; treatment	4,010,400	108,900

Iowa

Streets

Milford	Curbs, gutters, storm sewers	144,600	6,700
Vinton	Street widening, curbs; storm sewers	63,733	2,320

Utilities

Vinton	Street lighting system	26,016	1,180

Water Works

Imogene	New system	22,914	840
Lenox	Treatment plant improvements	37,843	1,720
Montezuma	Supply and treatment plant	154,500	4,800
Ocheyedan	New wells, transmission line	57,058	2,320

Sewers and Sewage Treatment

Alton	Treatment plant improvements	26,294	1,200
Eagle Grove	Improvements	185,000	3,000
Eldora	Extensions, outfall and interceptor sewers	66,150	2,400
Garnavillo	New system and treatment plant	129,727	7,120
Lenox	Treatment plant	39,120	1,740
New London	New system and treatment plant	113,601	3,500
Odebolt	Treatment plant	$ 49,256	$ 2,200
Ottumwa	23,000 ft. 24 in.-48 in. sewers, 3 pumping stations, treatment plant	2,124,480	50,000
Rock Valley	Treatment plant	77,750	3,500
Shenandoah	Storm sewer system	144,051	5,280
Vinton	(4 units) Extensions	179,163	8,080

Kansas

Water Works

Altamont	New system	93,940	3,120
Hudson	New system	46,462	1,560
Jewell City	Supply improvements, test wells	67,371	3,060
Pittsburg	Extensions	440,000	18,000
Williamsburg	New system	57,447	2,960

Sewers and Sewage Treatment

Arlington	New system and disposal plant	104,803	2,000
Buhler	Treatment plant alterations	54,750	2,000
Bushton	New system and treatment plant	99,300	3,020
Chanute	Treatment plant	434,910	15,940
Cunningham	New system and treatment plant	95,000	3,500
Eudora	Treatment plant	47,641	1,980
Hugoton	Lift station and force main	33,200	1,200
Hugoton	Sewage treatment plant	124,750	4,600
La Crosse	Storm sewer improvements	92,690	3,800
Leavenworth	Intercepting mains, lift stations; treatment	849,460	31,640
Paola	Combined water and sewer project	499,768	25,960
Pittsburg	Interceptor and outfall sewers; treatment	954,000	35,000
So. Hutchison	New system and treatment plant	190,000	6,980
White Water	New system and treatment plant	82,000	3,000

Kentucky

Water Works

Barbourville	Improving waterworks system; sewage system with treatment	$658,500	$19,800
Crofton	New system	97,000	3,400
Elizabethtown	Improvements	355,350	13,640
Hardinsburg	Improvements	50,229	1,780
Lawrenceburg	Water supply, filtration, storage, new lines	320,000	12,460
Marion	Raising of dam; new filters	150,000	6,420
White Plains	New system	68,600	2,500

Sewers and Sewage Treatment

Carrollton	Extensions; treatment plant	305,817	12,840
Elizabethtown	Extensions; treatment plant addition	450,000	17,460
Frankfort	New mains; 8 pumping stations; treatment plant	1,100,000	29,500
Hardinsburg	Improvements	37,877	1,320
Maysville	Treatment plant and revisions of sewer system	815,000	35,000
Somerset	Improvements, new lift stations	275,237	10,000

Louisiana

Bogalusa	Overpass	492,676	18,400

Maine

Bangor	Intercepting sewers	$555,000	$29,000

Maryland

Streets

Prince Georges County	Extensions of Arundel Road	492,000	20,000

Water Works

Denton	Distribution lines	71,280	3,900

Sewers and Sewage Treatment

Anne Arundel Co.	Storm drainage systems	712,535	31,940
Cumberland	Sewer extensions, treatment, incinerator	1,441,000	56,000

Location	Type	Estimated Cost	Planning Advance
Denton	1—Storm sewers	$ 14,800	$ 940
	2—Sanitary sewer system extensions	84,000	4,700
	3—Treatment plant	128,000	7,600
Middletown	New system and treatment plant	340,000	14,000
St. Michaels	New system and treatment plant	234,236	9,000
Salisbury	1—Interceptors, pumping station; force mains	474,000	18,440
	2—Trunk sewer; treatment plant	1,080,000	38,940

Massachusetts

Water Works

Berlin	New waterworks system	280,000	13,900
Blackstone	New waterworks system	400,000	17,400
Dracut	Engineering report on waterworks system	347,762	18,120
Holyoke	Dam, reservoir, 10-mi. 36 in. steel main	2,911,030	50,000
Peabody	2 miles new mains, 2 elevated tanks.	972,000	35,000

Sewers and Sewage Treatment

Chelmsford	1—Sewer system and treatment plant	418,380	18,920
	2—Pumping station and force mains.	254,180	9,920
	3—District system and treatment plant	490,700	18,800
Dracut	Sewers and treatment	1,155,680	46,120
Holyoke	Treatment plant	2,143,000	75,000
Nahant	Alterations and improvements	185,000	9,600
Newburyport	Interceptors, pumping, treatment	536,000	21,500
West Springfield	Pumping stations, interceptors and force mains	748,974	25,300

Michigan

Water Works

Eau Claire	New waterworks system	103,400	3,600
Escanaba	Filtration plant and storage facilities	700,000	22,120
Holt	New waterworks system	154,300	5,000
Reed City	Additions	112,000	5,000

Sewers and Sewage Treatment

Bay City	48 in. tunnel under Saginaw River, treatment plant	1,911,300	55,920
Grand Rapids	Treatment plant improvements	1,602,500	67,500
Grandville	Storm relief sewers; sewage treatment plant	123,000	4,000
Grosse Pointe Shores	Intercepting sewers; pumping stations	348,000	9,300
Howell	Storm sewers	300,000	8,240
Negaunee	Intercepting sewers; treatment plant	370,000	11,720
Okemos	New system and treatment plant	454,000	20,000

Minnesota

Water Works

Richfield	Complete waterworks system	4,318,869	101,900
St. Louis Park	1—Extensions; treatment plant	1,525,000	58,380
	2—Improved supply and distribution	1,100,000	35,440
	3—Underground reservoir	200,000	7,060
	4—Deep wells, pumping station, elevated storage	260,000	9,200

Sewers and Sewage Treatment

Kensington	Collection system and treatment plant	71,000	2,960
Mankato	Interceptor sewer and treatment plant	1,055,000	30,620
St. Louis Park	Extensions	3,360,000	106,350

Mississippi

Streets, Bridges and Viaducts

Jackson	6-lane traffic artery, viaduct, underpass and approaches	2,286,000	60,000

Water Works

Amory	1—Treatment plant improvements	71,100	1,940
	2—Distribution mains	192,600	5,280
Artesia	New System	57,000	1,520
Grenada	Water mains	79,959	2,600

Sewers and Sewage Treatment

Amory	Extensions	237,600	6,560
Booneville	Sewers, pump stations, treatment plants	$175,000	$6,020
Columbus	Extensions, lift station	930,714	30,300
Grenada	Storm drains	123,599	3,840
	Sewer extensions and treatment plant	233,446	7,880
Jackson	1—System in Eubanks Creek area	396,302	9,380
	2—System in Lynch Creek area	404,800	9,580
Tupelo	1—Extensions and additions	760,000	15,260
	2—Treatment plant	290,000	7,760
West Point	Treatment plant improvements	93,000	5,240

Streets and Bridges

Monroe Co.	Improvements of County roads, including drainage	189,243	7,060
Prentiss Co.	Road improvements; drainage; bridges	279,121	10,280

Missouri

Streets

Higginsville	Improvements, including storm sewers	200,300	7,860
Mexico	(6 units) Paving, curbs, gutters, drainage	1,123,674	41,520

Water Works

Bosworth	Complete system	95,230	3,760
Gainesville	Complete system	46,950	1,720
Maysville	Improvements	55,000	2,040
Pacific	Improvements	50,000	3,000

Sewers and Sewage Treatment

Chaffee	Extensions and treatment plant	195,000	8,620
Maryville	Sewers, treatment plant	237,129	9,500
Overland	Storm sewers	694,000	21,000
Poplar Bluff	1—167,300 ft. 8 in.-24 in. VC pipe, 536 manholes, 4 lift stations, and force mains	625,000	23,660
	2—12,700 ft. 15 in.-48 in. VC pipe, 7 lift stations,and CI pressure main	700,000	26,400
Pexico	Treatment plant	40,261	1,780
Rolla	Extensions and treatment plant	419,000	13,460
Stanberry	Treatment plant	118,955	4,420
Tarkio	Treatment plant	190,000	7,200
Trenton	Interceptors, lift stations; treatment	398,240	12,540
University City	1—Improvements to sanitary system	2,610,000	60,000
	2—18,600 ft. of storm water channel, 6 bridges		

Montana

Streets

Sidney	Paving, curbs, gutters	494,541	20,780

Water Works

Dillon	Renovations; new source	231,750	10,000
Harlem	Improvements	33,000	1,500
Hobson	New system	75,000	4,940

Sewers and Sewage Treatment

Hamilton	Collection system; treatment plant	305,800	12,300
Helena	Additions; treatment plant	682,270	28,500

Nebraska

Water Works

Nebraska City	Pumping plant, elevated tank	226,907	8,100
Scribner	Supply improvements	48,874	2,220
Walthill	Extensions; iron removal plant	41,000	760

Sewers and Sewage Treatment

Allen	New system, treatment plant	63,938	2,320
Ansley	New system, treatment plant	87,700	3,200
Beemer	Treatment plant	46,650	1,660
Crofton	Treatment plant	38,150	1,400
Hebron	Intercepting sewer; treatment plant	94,511	3,400
Louisville	Treatment plant	27,151	980
Pender	Extensions; treatment plant	89,666	1,640
Petersburg	New system; treatment plant	80,937	2,140
Polk	New system; treatment plant	82,473	3,000
Sterling	New system; treatment plant	77,621	2,840

New Hampshire

Location	Type	Estimated Cost	Planning Advance
Water Works			
Rye	Additional wells; storage and pumping	$ 450,000	$ 13,300
Parking Facilities			
Concord	2-level garage for 361 cars	474,800	15,000

New Jersey

Location	Type	Estimated Cost	Planning Advance
Sewers and Sewage Treatment			
(Bergen Co.) Sewer Authority)	1—15,500 ft. 72 in.-84 in. and 6,300 ft. 12 in.-21 in. sewers	4,450,000	140,000
	2—27,500 ft. 46 in-66 in., 9,500 ft. 26 in.-42 in., and 3,000 ft., 18 in.-24 in. sewers	3,475,000	105,000
Eatontown	System; treatment plant	297,550	13,000
Elisabeth	1—Interceptors; and pumping station	3,121,722	91,040
	2—Intercepting sewer	449,988	13,120
	3—Regulator chambers and branches	169,248	4,920
	4—Bay Way Branch intercepting sewer	207,400	6,040
Hasbrouck Hgts.	Treatment plant additions	120,000	4,000
	Storm drains (3 units)	318,000	9,740
Maywood	Storm drains	34,500	1,200
Paterson	Storm water diversion main	110,000	4,000
Perth Amboy	Storm sewers	193,250	7,000

New Mexico

Location	Type	Estimated Cost	Planning Advance
Sewers and Sewage Treatment			
Grants	Additions and treatment; also water system additions	55,000	2,240
Tucumcari	Additions and treatment plant	269,250	9,100

New York

Location	Type	Estimated Cost	Planning Advance
Refuse Disposal			
Long Beach	Incinerator	340,600	18,600
Water Works			
Albany	Filtration plant additions	540,000	19,740
Long Beach	Treatment plant	450,000	27,000
Waterloo	Additions; new source	212,110	7,500
Sewers and Sewage Treatment			
Buffalo	Sewage treatment additions (4 projects)	2,121,400	77,600
DeWitt	New system	367,700	13,400
Fallsburgh	System and treatment plan	387,000	11,140
Hornell	Treatment plant additions	225,330	11,320
Orangetown	Pumping station, sewers, treatment plant	992,000	35,000
Salina	New system	264,200	9,600

North Carolina

Location	Type	Estimated Cost	Planning Advance
Water Works			
Lenoir	Filtration plant additions	290,370	9,580
Raleigh	1—Filtration plant additions	1,190,000	50,280
	2—Increased storage at Lake Johnson	174,600	6,400
	3—Elevated steel tank; feeder mains	307,000	12,820
Wilson	64,000 ft. of mains	330,000	12,400
Sewers and Sewage Treatment			
Asheboro	Extensions (2 units)	182,030	5,980
Asheville	1—51,600 lf of new interception sewers, 20,000 lf to be repaired	873,356	32,160
	2—Sewage treatment works	1,287,000	51,400
Raleigh	Outfall sewers, treatment works	1,445,000	60,580
	Storm sewers (4 units)	2,160,000	81,040
Williamston	Extensions	100,000	2,000
Wilson	Storm drains	199,000	7,320

North Dakota

Location	Type	Estimated Cost	Planning Advance
Water Works			
Rhame	Extensions	44,000	1,420
Wildrose	New system	72,000	1,980

Ohio

Location	Type	Estimated Cost	Planning Advance
Streets			
East Liverpool	Paving of 9 streets	$ 692,875	$ 22,060
Airports			
Columbus	Additions and improvements at Port Columbus	3,943,250	98,800
Portsmouth	Airport with administration building	475,000	12,000
Water Works			
Columbus	Supply dam and reservoir	6,517,000	155,000
McComb	New source, storage, treatment plant	118,000	4,840
Richland Co.	Report covering facilities outside Mansfield	520,120	4,000
Springboro	New system	78,000	3,200
Woodsville	New supply, reservoir, treatment plant	117,200	3,600
Sewers and Sewage Treatment			
Ashtabula	Treatment plant	870,000	28,000
Clyde	Treatment plant additions	100,000	3,100
Columbus	Treatment plant additions	882,000	35,000
Defiance	Interceptors, pumping, treatment plant	1,100,000	32,460
Eastlake	Sewer system and treatment; storm drains	1,858,200	93,880
Gallipolis	Extensions; treatment plant	722,000	21,780
Genoa	Interceptors, treatment plant	240,000	8,360
Gibsonburg	Additions; treatment plant	415,000	13,000
Girard	Interceptors, lift stations, treatment	486,300	18,000
Hebron	New system and treatment plant	138,000	7,800
Ironton	1—Repairs to sanitary sewers	158,500	7,640
	2—Storm sewers	41,000	1,900
Lakeline	New sewer lines	34,675	840
Lorain	1—Interceptors, pumping stations	943,100	31,500
	2—Treatment plant	1,259,490	43,500
Loveland	New system and treatment plant	377,180	12,700
Marietta	Additions; treatment plant	1,437,440	50,440
Miamisburg	Additions	104,420	4,700
Napoleon	1—Storm relief sewers	436,000	17,000
	2—Treatment plant	578,500	22,500
	3—New sewer lines	284,800	10,980
Newton Falls	Interceptors, pumping, force mains	260,000	13,500
	Treatment plant	295,000	13,000
No. Baltimore	Treatment Plant	235,000	7,960
Oak Harbor	Treatment plant	315,000	10,240
Orrville	Treatment plant	345,400	14,560
Perrysburg	Additions	78,000	2,900
Richland Co.	Report on sewage facilities outside Mansfield	645,800	10,500
Sandusky	1—Trunk sewers and pumping station	344,700	15,420
	2—Interceptors, pumping station, force main	1,164,300	47,620
	3—Treatment plant and outfall sewer	1,854,400	74,840
	4—Storm sewers	244,100	10,700
Sherwood	Storm sewers	30,000	1,700
Timber Lake	New sewer lines	57,200	1,640
Toronto	Additions; treatment plant; storm drainage	544,340	21,000
Troy	Additions, treatment plant	490,000	23,500
	Storm sewer extensions	461,000	20,500
Tuscarawas	New system and treatment plant	111,500	4,500
Youngstown	1—Intercepting sewers	3,604,700	122,000
	2—First unit of treatment plant	2,792,300	76,000
	3—Digesters, vacuum filters, incinerators	2,613,500	67,000

Oklahoma

Location	Type	Estimated Cost	Planning Advance
Roads and Bridges			
Okmulgee Co.	Highway improvements and 4 bridges	362,760	13,220
Sewers and Sewage Treatment			
Okmulgee	Treatment plant and outfall sewer	455,500	14,900
Warr Acres	New mains and outfall line	172,975	8,240

Oregon

Location	Type	Estimated Cost	Planning Advance
Vale	Sewage treatment plant	77,000	1,500

Location	Type	Estimated Cost	Planning Advance
Pennsylvania			
Water Works			
Ambridge	Development of new supply; extensions	$683,000	$23,500
Fairfield	New system	52,843	1,360
Hempfield Twp Westmoreland Co.	Filter plant and storage; purchase of existing system	193,212	6,280
Hummels Wharf	Combined sewer and waterworks system	412,199	7,280
Waynesboro	Dam and reservoir	425,000	16,000
Youngstown	Distribution lines and purchase of Water Company	263,045	6,000
Sewers and Sewage Treatment			
Allegheny Co. Sanitary Authority	59 Miles of intercepting sewers and force mains, and treatment plant to serve 59 municipalities and 30 industries	59,000,000	500,000
Archbald	Treatment plants	268,000	10,000
Bangor	New system and treatment plant	880,000	22,000
Berks County	System for Hyde Park and adjoining area	320,887	10,080
Brockton	Additions and treatment plant	173,500	4,500
Carbondale	1—Interceptors and rehabilitation of old lines	330,000	12,000
	2—Treatment plant	767,000	28,000
Clairton	Interceptors, pumping station; treatment plant	800,000	28,500
Coraopolis	Interceptors, pumping station; treatment plant	930,000	26,600
Dawson	Treatment plant	66,912	1,860
Elizabeth	Interceptor; treatment plant	224,500	4,000
Elk County	Collection system for Benzinger Township	61,129	2,740
Fleetwood	New system and treatment plant	406,279	15,080
Freeland	Additions; treatment plant	431,590	11,000
Harmony	Extensions	194,400	7,500
Johnsonburg	Additions; treatment plant	275,411	8,540
McAdoo	Interceptor; treatment plant	247,331	6,320
McKeesport	1—Interceptors	2,020,000	58,000
	2—Pumping stations and treatment plant	1,420,000	40,000
Minersville	Additions; treatment plant	489,301	14,800
Montgomery Co.	Collection system in West Norriton Township	813,680	26,140
North Catasauqua	Collection system	323,500	13,500
Oakmont	Treatment plant; incinerator	1,090,000	22,100
Olyphant	Additions; treatment plant	395,378	13,740
Palo Alto	Additions; treatment plant	100,000	3,500
Point Marion	Additions; treatment plant	215,000	8,400
Port Carbon	Additions; treatment plant	130,500	4,000
Saxton	New system and treatment plant	172,500	9,080
Schuylkill Co.	Additions; treatment plant for Blythe Township	100,000	2,500
	Treatment plant in Klein Township	117,726	2,960
State College	Additions; treatment plant	1,916,000	55,240
Tamaqua	Additions; treatment plant	747,500	12,000
Vanderbilt	Additions; treatment plant	171,520	5,780
Rhode Island			
Providence	Swimming pools and recreation centers	996,000	38,240
South Carolina			
Water Works			
Saluda	Extensions	58,385	2,060
Sewer Projects			
Charleston	Extensions	238,611	8,600
Georgetown	Extensions	133,286	4,840
South Dakota			
Streets			
Corsica	Improvements	22,000	1,100
Hot Springs	Grading, surfacing, curbs, gutters	133,420	5,600

When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

Location	Type	Estimated Cost	Planning Advance
	Water Works		
Kennebec	Additions and alterations	$56,000	$2,500
Volga	Water and sewer systems; sewage treatment	185,125	7,660

Tennessee

	Streets and Bridges		
Hamilton Co.	12 highway bridges	677,300	22,400
Madison Co.	58 highway bridges	638,760	24,200
Nashville	Underground parking garage	4,255,000	180,000
	Water Works		
Hartland	Supply, storage, mains	125,500	4,600
Union City	New well, pumps, treatment and elevated tank	191,000	7,520
	Sewers and Sewage Treatment		
Covington	Additions; treatment plant	275,000	11,020
Davidson Co.	System and treatment plant for First Suburban Utility District	1,437,500	58,600
Dickson	Extensions; treatment plant	189,223	6,880
Franklin	Extensions; treatment plant	311,000	13,000
Sparta	Extensions	60,620	2,960
Union City	Extensions; treatment plant	315,000	12,660

Texas

	Water Works		
Chambers Co.	New system	167,000	6,300
Mineral Wells	Additions	162,000	5,800
Rosebud	Extensions, elevated tank	88,275	3,740
Waco	Treatment plant additions	365,000	13,240
	Sewers and Sewage Treatment		
Aubrey	New system and treatment plant	40,000	1,700
Dickinson	Treatment plant additions; lift station	70,000	2,760
Galveston Co.	Treatment plant	211,000	8,240
Marble Falls	New system and treatment plant	217,150	9,000
Mineral Wells	Additions	75,000	2,640
Saginaw	New system and treatment plant	95,000	3,740
Chambers Co.	New system and treatment plant	89,300	3,700

Utah

	Water Works		
Centerville	New mains, reservoir	109,269	3,800
North Ogden	New mains, reservoir	86,600	3,140
Tremonton	Additions	132,400	1,300
	Sewers and Sewage Treatment		
Brigham	Extensions, disposal plant, outfall sewer	245,000	8,800
Murray	New system with treatment plant	945,000	34,720
North Ogden	New system with treatment plant	283,000	11,200
Ogden	Treatment plant	833,000	30,000
Richfield	Improvements; treatment plant	165,000	7,300

Vermont

	Water Works		
Essex Center	New System	70,450	2,500
	Sewers and Sewage Treatment		
Burlington	Interceptors, pumping station, and treatment	741,000	21,000

Virginia

	Water Works		
Courtland	New system	75,000	4,060
Winchester	New supply, 16-mile main, and treatment plant	2,085,000	68,000
	Sewers and Sewage Treatment		
Abingdon	Extensions; treatment plant	163,000	6,000
Hopewell	Additions, treatment plant	860,000	31,640
Luray	Additions; treatment plant	157,080	5,080
Norfolk Co.	Collection system in Deep Creek Sanitary District No. 1	220,000	9,740
South Norfolk	Sewer to serve Cloverdale Development	18,503	620
Suffolk	Additions; treatment plant	541,133	17,860
Warwick Co.	Additions to connect Ferguson Park and Huntington Heights with Hampton Roads system	86,860	3,360

Washington

Bridges

Location	Type	Estimated Cost	Planning Advance
Bellingham	Bridge and approaches	$332,900	$11,500
Port Townsend	Bridge over Puget Sound between Indian Island and Marrowstone	234,000	9,000

Water Works

Cosmopolis	New system	125,000	6,000
Northport	Additions and improvements	64,000	2,440
Spanaway	New System	314,000	15,600

Sewers and Sewage Treatment

Anacortes	Additions; treatment plant	660,000	20,000
Brewster	New system and treatment plant	120,800	5,000
Gig Harbor	New system and treatment plant	203,000	9,400
Kelso	Additions; treatment plant	800,241	20,820
Bellevue SD	System with treatment plant	545,000	20,000
Bryn-Mawr-Lake Ridge SD	System with disposal plant	547,500	17,500
Three Points SD	System with disposal plant	300,000	10,700
Val-Vue SD	Storm and sanitary sewer additions	115,250	5,550
White Center SD	System with treatment plant	666,300	22,000
Raymond	Interceptors, pumping station, treatment	254,600	14,000
Tumwater	New system	289,000	10,000
Winlock	Additions, treatment plant	90,000	5,000

West Virginia

Bridge

Dunbar	Highway Bridge over Great Kanawha River	1,619,000	48,700

Sewers and Sewage Treatment

Barboursville	Treatment plant	223,000	9,000
Buckhannon	Extensions; treatment plant	431,318	26,100
Elkins	Additions; treatment plant	730,000	20,000
Huntington	1—gravity and force mains, pumping station	2,880,900	66,400
	2—Treatment plant	1,416,501	39,000
Marmet	Additions; treatment plant	$227,200	$7,000
Mullens	Extensions; treatment plant	150,000	7,740
St. Albans	Additions; treatment plant	750,000	29,400
Wierton	Additions; treatment works	380,500	14,000

Wisconsin

Water Works

Blue River	New system	88,431	3,160
Darien	New system	110,000	3,000
Eagle	New system	100,520	3,680
Fairchild	New system	104,842	3,840
Hancock	New system	51,850	2,400
Plainfield	New system	79,087	2,280
Webster	New system	76,963	3,100

Sewers and Sewage Treatment

Ashland	Extensions; treatment plant	1,000,000	36,000
Augusta	Treatment plant	91,358	2,060
Bayfield	Additions; treatment plant	129,148	4,600
Colfax	Treatment plant	95,000	4,000
Darien	New system with treatment plant	140,000	1,400
Darlington	Additions; treatment plant	163,376	5,820
Durand	Treatment plant	95,000	1,900
Oconto	Treatment plant	574,656	23,800
Plainfield	New system with treatment plant	97,899	2,860
Shorewood	Improvements and extensions	867,403	9,800
Strum	New system and treatment plant	102,930	3,060
Washburn	Treatment plant	124,292	4,320
Whitehall	Extensions; treatment plant	173,470	7,200

Wyoming

Streets

New Castle	Improvements	104,256	4,260
Rawlins	Grading, drainage, sidewalks, curbs, gutters	228,467	7,360

Water Works

Dubois	Rehabilitation and expansion	70,000	3,000
Ranchester	Improvements	29,700	2,400

Sewers and Sewage Treatment

Dubois	New system and treatment plant	80,000	3,600

Lithographed on stone by Edward A. Wilson

PUBLIC WORKS DIGESTS

THIS section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of all principal articles in these publications.

THE WATER WORKS DIGEST

Colorimetric Hardness Titration

Within a relatively short period the direct titration methods for hardness and calcium have received widespread acceptance because of their convenience, rapidity and accuracy. However, there is necessity for certain precautions in interpreting the hardness values obtained, since the sensitivity of the hardness titration detects contaminating influences not shown by the soap hardness test. Caution must be used in filtering samples prior to analysis and in interpreting the small quantity of hardness contributed by glass bottles.

J. D. Betz and C. A. Noll—"Further Studies With the Direct Colorimetric Hardness Titration;" *Journal, Am. Water Works Ass'n*, August.

Industrial Demand For Process Water

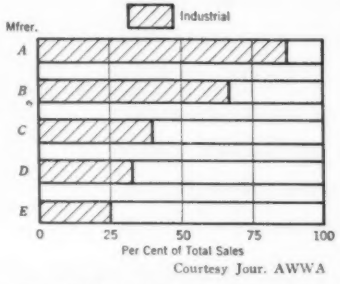
The industrial demand for water is one of the most important factors in water shortages. One paper mill treats 44 mgd; another, 22 mgd. A chemical plant recently installed a water treatment plant to demineralize nearly 6 mgd. Practically all industrial uses of water fall within one or more of the following classifications: (1) cooling, (2) processing, (3) power generation, (4) sanitary services, (5) fire protection, (6) air conditioning, washing, etc. Cooling water far exceeds all others. Large electric generating stations require 500,000 gpm or more for surface condenser operation. The steel industry requires 65,000 gal. per ton of finished product. The U. S. Census of Manufacturers estimated that in 1947 the various industries used a total of 21 billion gallons per day. (About ¾ of this, however, was re-used water.) Among the corrective measures suggested are discouragement of overindustrialization within critical, or potentially critical, watersheds. Decentralization of industrial users of large volumes of water. Inter and intrastate control and regulation of flood waters. Encouragement of salt water usage as a conservation measure. Expansion of the activities of the state and federal agencies handling critical underground water resources.

Sheppard T. Powell and Hilary E. Bacon—"Magnitude of Industrial Demand for Process Water;" *Journal, Am. Water Works Ass'n*, August.

Tastes and Odors Caused by Detergents

To determine what effect on palatability of a water supply might be caused by discharge into a river of wastes containing detergents, laboratory tests were made using four different detergents, both alone and mixed with bland lard, the latter to simulate the effluents from cleaning operations. At 5 ppm concentration, tastes with intensities of 2 to 9 of a bitter or soapy characteristic were caused by three detergents, none by the fourth. Soapy or sewage odor of 1.5 to 18 intensity were caused by all four. Where lard was added, the tastes were disagreeable and rancid and the odors rancid and chemical. The addition of chlorine and of chlorine dioxide intensified both tastes and odors, in some cases changing the character of the odor. By use of activated carbon (Aqua Nuchar), taste and odor were completely removed from two detergents, and almost completely from the other two. It is suggested that better results can generally be obtained by treating with carbon before chlorination.

J. B. Filicky—"A study of the Influence of Some Industrial and Domestic Type Detergents on Tastes and Odors;" *Taste and Odor Control Journal*, August.



Courtesy Jour. AWWA

● ***SALES of water treatment equipment to industry.***

Surveying Drilling of Wells

During 1949, Houston, Tex., had 18 wells under contract, and 10 were completed that year. Every effort was made to obtain adequate and reliable test information during the construction. Water from the various depths was analyzed. An electric log of the well was taken, followed immediately by a caliper survey which showed actual diameter of the hole and areas of caving. It also permitted selecting the proper size and location of the packer of the drill stem testing tool.

Temperature surveys were made of 3 wells but were discontinued as furnishing no additional information. A tool was built for measuring a 30″ underreaming hole (believed to be the first). In all the wells in which it was used, this tool revealed that the underreaming had not been completed as directed.

Clyde R. Harvill—"Houston Uses Electric Log on New Wells;" *PUBLIC WORKS*, September.

Annual Reports

Present water works reports tend to accomplish too little by attempting too much. They try to reach two groups of readers—professional and general public. The committee recommends a report printed in two parts, one for each of these two classes. One would be in narrative style with pictures and drawings, dealing with matters of particular interest to the public. The other would include all the principal statistical and accounting data needed to picture the property's operations and possibly some drawings and explanations to help interpret them. The latter would be distributed to only managers of other properties and consulting engineers and might be mimeographed. The publicly-owned property will want to place major emphasis on service to the public; the privately-owned, to profits accounting. The popular reports should be distributed to at least one in each 60-80 persons in the community, choosing those interested in civic affairs, such as members of all civic clubs. It should deal with such matters as property improvements; trends in income and expenses; trends in water consumption, particularly in the home; the effect of softened water (if softening is practiced) in terms of cost and savings to the public; improvements in service; explanations of practices that have occasioned some misunderstanding by consumers; etc. It should conclude with the balance sheet and the earnings statement. Reference to the report manual prepared by the International City Managers Ass'n. is recommended. The type should not be smaller than 10 pt., and be keyed to the drawings and pictures, with short captions in large, readable type. There should be at least two or three colors—"Color creates attention, but not sustained interest." It should not exceed 30 or 40 pages, generally smaller. The report for professional readers should be on 8½″ x 11″ paper.

Committee on Water Department Reports—"Water Department Annual Reports;" *Journal, Am. Water Works Ass'n.*, August.

Coal-Tar Enamel On Steel Water Pipes

In the past few years the U. S. Bureau of Reclamation has learned things about coal-tar enamel that are thought to be of interest. As manufactured in modern, plasticized form for the water works industry, it is only 15 to 20 years old. By a variation in processing made about 1930, the enamel acquired a more plastic or rubbery character. The old form of enamel in one instance cracked and disbonded from an 80″ steel pipe at a minimum temperature of 5° F. The new enamel has withstood temperatures as low as —43° F. with only minor damage; however, it is not considered a good risk to expose it to temperatures under —20° F.

A flow coefficient of 0.011 for Kutter's *n*, or 130 for the Hazen-Williams *C* is reasonable for steel pipe lined with coal-tar enamel. A wrapped coal-tar enamel coating,

supplemented by cathodic protection as needed, is believed to provide virtually permanent protection to the exterior of buried steel pipe.

Graydon E. Burnett—"Performance of Coal-Tar Enamel on Steel Water Pipe and Penstocks;" *Journal, Am. Water Works Ass'n*, August.

Aquatic Growths in Impounding Reservoirs

The use of the phenoxyacetic compounds, 2,4-D and 2,4,5-T for control of submersed plants in large bodies of water is not practicable at present because of the expense involved. Of all of the comparatively new chemical agents known to the author, nigrosine offers the only safe and economical control method which may possibly be of practical value against submersed aquatic plants in impounding reservoirs. It has proved successful at rates as low as 10 lb. per surface acre. It is harmless to fish and other aquatic organisms.

For the control or eradication of plant growths on the shores and embankments of impounding reservoirs, 2,4-D and 2,4,5-T and their salts or esters may be employed. Some plants, such as water lilies and cattails, have waxy coatings which can best be penetrated with oil formulations. Complete eradication requires successive applications. In discussing the paper, Martin E. Flentje said that in 1949 his company found "Borascu" (a borate ore akin to borax) proved very effective on reservoir banks, applied at the rate of 12 lb. per 100 sq. ft. It is a soil sterilizer and kills all vegetation.

Eugene W. Surber—"Control of Aquatic Growths in Impounding Reservoirs;" *Journal, Am. Water Works Ass'n.*, August.

BIBLIOGRAPHY

American Water Works Ass'n Journal

Water Department Annual Reports. Committee Report. August, Pp. 715-728.
Living With the Atom. By *Norman R. Beers*, Editor, Nucleonics. August, Pp. 729-734.
Control of Aquatic Growths in Impounding Reservoirs. By *Eugene W. Surber*, U.S.-P.H.S. August, Pp. 735-740.
Performance of Coal-Tar Enamel on Steel Water Pipe and Penstocks. By *Graydon E. Burnett*, Head, Paint Lab., U. S. Bureau of Reclamation. August, Pp. 741-748.
Further Studies with the Direct Colorimetric Hardness Titration. By *J. D. Betz* and *C. A. Noll*. August, Pp. 749-754.
Basic Water Use Doctrines and State Water Control Agencies. Committee Report. August, Pp. 755-773.
Electrical Conductivity. By *L. V. Wilcox*, Soil Scientist, U.S. Dept. of Agriculture. August, Pp. 775-776.
Magnitude of Industrial Demand for Process Water. By *Sheppard T. Powell* and *Hilary E. Bacon*, Cons. Chem. Engrs. August, Pp. 777-785.
Desalting Sea Water for Domestic Use. By *Wm. W. Aultman*, Water Purif. Engr., Met. Dist. of So. California. August, Pp. 786-796.

American City

How Much Water Should a Reservoir Hold? By *R. G. Kinkaid* and *Glenn E. Hands*, Cons. Engrs. September, Pp. 96-97.

Civil Engineering

King-Size Venturi Measures New York's Water Supply. By *Walter J. Gress*, Eng'r., Bd. of Water Supply, New York, N. Y. September, Pp. 37-39.

La Technique Sanitaire (France)

La Sterilisation des Eaux par le Chlore et l'Ozone. By *P. Koch*, Ing. des Ponts et Chausses, and A. Vibest, Ing. de Paris. June, Pp. 117-133.

Public Works

Fluoridation of Water Supplies. By *Henry F. Munroe*, Chem. Engr., Proportioneers, September, Pp. 39-41.
Houston Uses Electric Log on New Wells. By *Clyde R. Harvill*, Engr. Water Dept. September, Pp. 49, 91.

The Surveyor (England)

Some Notes on Silica-Alum Treatment of River Water. By *J. V. Telfer*, Deputy Water Engr., Warrington. Aug. 18, P. 479.

Taste and Odor Control Journal

A Study of the Influence of Some Industrial and Domestic Type Detergents on Tastes and Odors. By *J. G. Filicky*, Chem. W. Va. Pulp & Paper Co. August, Pp. 1-7.

Boosting Water Pressure in Buildings

In these days of over-taxed water facilities, a problem often encountered is the reduction, in office buildings or apartments, of city water pressures during some periods of the day, and the boosting of pressures during other periods. This is discussed in the *Autocon Rambler* of Automatic Control Co. One solution would be the installation of a pressure tank, but in many cases city pressure is sufficient for 75% of the time, and when that is so a booster pump may be more economical.

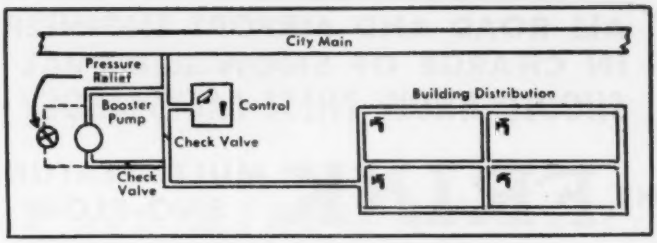
For this type of installation, a pressure control must be mounted in the pump suction line and regulated by the pressure in the city main. This control is set to operate the booster pump only when the city pressure drops below a predetermined limit; and to stop it when a safe high pressure is reached in the city mains. The type of pump used is important. It must have a relatively flat head curve, with shut-off head at or slightly below the pressure desired in the building. This permits the pump to churn without damage during the time no water is being used in the building. A small by-pass from the pump discharge to the suction, with a pressure relief valve set slightly below the shut-off head of the pump, allows a small amount of water to recirculate for pump cooling purposes.

An example of the installation is given. An office building is assumed where water use may range from nothing to a high demand. The minimum pressure to supply all floors is 45 psi in the basement. The city supply, at various times, and for 6 hours a day, drops to a low of 30 psi, which will not supply all floors.

With the installation outlined above, just as soon as the city pressure drops below 45 psi, the control, after suitable time delays, starts the booster pump. In case no water is being used in the building, the pump churns and maintains a pressure of 45 psi. A check valve prevents pumping back into the city main. The pump continues to run during periods of low pressure and until the pressure is restored to a specified amount, a 55 psi, at which time the controls, after necessary time delays, shut off the pump.

To offset running surges that may be present in any overtaxed water system, the control must be equipped with time delays, both for starting and stopping, to prevent false pump operation and reduces power costs.

This discussion considers only a single pump. When several pumps are used, the problem is more complicated, but yields to the same general principles.



● ***TYPICAL installation of a single booster pump.***

When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

PUBLIC WORKS DIGESTS

THE HIGHWAY AND AIRPORT DIGEST

Maintaining Winter Service

Schuyler, N. Y., Highway Dept. removes snow from 104 mi. of State highways and 102 mi. of county roads. After a snow storm begins, the first move is to round-trip the hills to facilitate sanding. For removing ice, motor graders with ice blades are used systematically. Last winter a "Gradall" machine was used to remove snow from ditches during the spring thaw. Motorists are urged to carry stone ballast in sacks to give better traction, the county furnishing sacks of crushed stone weighing 100 to 200 lbs. to doctors, nurses and some others, without cost but requesting that they be returned in the spring.

Ernest B. Porter—"New Heavy Plows Plus Some New Tricks, Some Old;" *Roads and Streets*, August.

Grouting as a Slide Stopper

U. S. Route 460 in Virginia crosses a fault for a distance of 250 ft. For nearly 10 yr. this has caused slides in cuts, and settlements in fills of as much as 10″. Borings revealed no rock at 47 ft. depth, only sand, clay and broken shale, and it was estimated by geological engineers that there was 24,000 cu. yd. of the unstable mass, reaching a depth of 75 ft. It has been decided to try pumping grout into the soil to consolidate it. A grout of portland cement and fine sand will be pumped through 2″ pipes driven down to wet or soft zones. This method has been used extensively by railroads but never before on a Virginia highway.

"Grouting as Slide Stopper Being Tried in Virginia;" *Roads and Streets*, August.

Testing Piles for Bridge Foundations

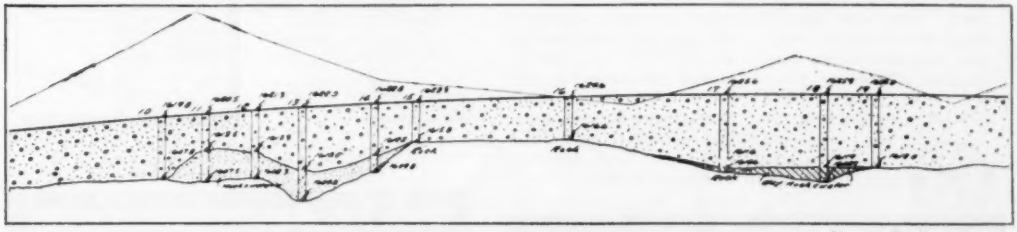
The California Div. of Highways recently built 18 concrete slab bridges founded on piles, with a design load of 20 tons per pile. The piles were made by boring 14″ holes with a truck-mounted auger-type earth drill to a depth of 15 to 22 ft., placing reinforcing bars, and pouring in concrete, extending the pile several feet above the ground line in steel forms.

The bearing capacity of the piles was tested at two sites by means of a new testing equipment. An additional pile to serve as a test pile was placed midway between two plan piles, and each of these two was provided with four additional 1″ bars extending from the bottom of the pile to 2 ft. above its top. A steel truss was set across the tops of these three piles and fastened to the two plan piles by bending the protruding bars over the base of truss and welding them. A 115-ton hydraulic jack was placed between the truss and the top of the test pile, and means provided for measuring the pressure and the settlement of the test pile. A constant pressure was maintained for a time, then removed to measure the rebound; then a greater pressure was applied, and this was repeated until failure of the test pile. Failure occurred under a load of 75 tons on a 22 ft. pile and 35 tons on a 16-ft. pile at another location.

G. C. Smith—"Bridge Department Develops Portable Pile Testing Rig;" *California Highways and Public Works*, July-August.

Traffic Line Marking in Missouri

Missouri some years ago developed a striping machine that painted as much as 100 miles of stripe a day. With 10,000 miles to stripe, one machine could cover the entire mileage once a year, if work could continue throughout the year. But striping bituminous surfaces is not satisfactory during the warm months of bleeding and seasonal patching, and on these it is not begun until after Oct. 1. The percentage of bituminous roads has increased until now 65% of the striping is done on such roads, and a number of machines is necessary. Each of the 10 highway divisions now has its own machine, but as it is used only a few months of the year, a modification of the original machine has been developed which can be attached to a ½-ton truck for use, and removed and stored when not in use. The author describes this equipment in detail. They cost approximately $600 each. Good striper drivers and operators are hard to develop, and the quality of the workmanship is not yet entirely satisfactory but it is expected to



Courtesy Roads and Streets

● ***PROFILE view of slide prevention by grouting.***

improve with practice. One difficulty is in obtaining a proper rate of application of the glass spheres, 4½ to 5 lb. per gal. of paint being aimed at. A good metering device for these spheres is desired. Yellow paint is applied at the rate of 20 to 24 gal. per mile of 4" stripe, black paint at 17 to 19 gal., and broken white lines at 7 to 8 gal. For white and yellow paints a phenolic modified oleo-resinous varnish vehicle is used. The black paint is usually a tar pitch, cut back with a closely fractionated aromatic solvent.

Leon W. Corder—"Missouri's Big Traffic Striper Has a Litter of Pups;" *Better Roads*, August.

Oil-Spraying Concrete Pavement

New York State Highway Dept. finds that, while air entrained concrete provides reasonable protection against the weaker salt solutions, roads receiving amounts of salt up to 600 lb. per mile of two-lane pavement were being affected. To obtain additional protection, the Dept. now applies a 1:1 mixture of a refined neutral petroleum distillate oil and petroleum mineral spirit. This is applied by a truck-mounted spraying apparatus with a 12 ft. spray bar. A first application at the rate of 1/15 gal. per sq. yd. was followed the next year (1949) with one at 1/34 gal. (A second application at 1/17 gal. had been found not to be absorbed and to make the pavement slippery). Within ten minutes the oil was completely absorbed and in an hour the pavement was dry. This year, the oil is being applied to new pavements as soon as the curing period has elapsed and before the transverse joints have been filled. On one short stretch of road the oil is applied immediately after finishing with the idea of using the oil application for curing also.

"New York Uses Oil Spray to Protect Concrete Pavement;" *Engineering News-Record*, Aug. 24.

Cleaning Joints in Concrete Pavements

A paper prepared at the English Road Research Laboratory states that joints in concrete pavement must be kept well sealed, and this may involve periodic cleaning and resealing. Machines for this are described under three heads—raking and cutting, dust removing, and heating and pouring. For cleaning the joints, two rotary cutting and one plow-type machine are described, all American make. An English firm makes one with a steel tooth mounted on the blade of a blade grader. Dust is removed by a rotating wire brush, or by a heated jet of compressed air, both American make. The filler is heated by oil in tanks developed in America for heating rubber-bitumen compounds. The English make pouring cans similar to a heavy watering can, but attention is called to funnel shaped cans such as one made by Aeroil Products Co.

P. L. Critchell—"Machines for Maintaining Joints in Concrete Pavements;" *Roads and Road Construction*, August.

BIBLIOGRAPHY

American City

How to Build Service into Asphalt Streets. By *Ladis H. Csanyi*, Prof. of Civ. Engr., Iowa State College. September, Pp. 120-122.

Better Roads

Missouri's Big Traffic Striper Has a Litter of Pups. By *Leon W. Corder*, Maint. Engr., Mo. State H'way Dept. August, Pp. 29-30, 35.

Utility Cuts: Plague of Urban Areas. By *Frank A. Howard*, Asst. Res. Engr., Va. Dept. of H'ways. August, Pp. 31-32, 39.

When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

Civil Engineering

Volcanic Clinkers Stabilize Fills on Hawaiian Highway. By *R. M. Belt*, Highway Engr., Dept. of Pub. Wks., Honolulu, Hawaii. September, Pp. 30-31.
Free Roads vs. Toll Roads. By *Roy E. Jorgensen*, Dep. Com'r and Chf. Engr., Connecticut Highway Dept. September, Pp. 40-44.

Construction Methods and Equipment

Highball Clearing at Hungry Horse. September, Pp. 42-46.

Engineering News-Record

New York Uses Oil Spray to Protect Concrete Pavement. Aug. 24, Pp. 32-33.

Public Works

How to Patch Holes in Pavements. September, Pp. 42-43.
Administration Building for State Highway Department. By *G. Albert Hill*, State H'way Com'r, Connecticut. September, Pp. 45-46.
How to Build Asphalt Sand-Mix Pavements. By *B. T. Collier*, County Eng'r. September, P. 74.

Roads and Engineering Construction

Jet Engines for Motor Trucks. By *Edward C. Wells*, V. P. Boeing Airplane Co. August, Pp. 79-80, 90.
Determining Roadway Requirements at Signalized Intersections. By *O. K. Normann* and *W. P. Walker*, U. S. B. P. R. August, Pp. 80-86, 93.

Roads and Road Construction (England)

Maintaining Joints in Concrete Pavements. By *P. L. Critchell*, Road Research Lab. August, Pp. 234-237.

Roads and Streets

New Heavy Plows (used for snow removal in a N. Y. county). By *Ernest B. Porter*, Supt. of H'ways, Schuyler Co., N. Y. August, Pp. 43-44.
Elevated, Inclined Snow Fence Studied. By *C. Fraser*, Div. Engr., Ontario Dept. of H'ways. August, Pp. 45-46.
Grouting as Slide Stopper Being Tried in Virginia. August, P. 47.

The Surveyor (England)

Rubberized Asphalt Road Surfacing in Singapore. Aug. 18, Pp. 485-486.

Modernized Street Lighting for Decatur

Decatur, Ala., has just completed a street lighting modernization program which doubles the amount of light on its downtown streets. In the business section, the city has installed 119 modern mercury-vapor luminaires which burn 16,000-lumen lamps in a horizontal position. These, which were supplied by General Electric, provide an illumination level of 1.8 foot-candles, or more than 150% of IES recommendations for main arteries. The luminaires, mounted 30 ft. above the pavement on Union Metal Octaflute poles, replace upright fixtures which wasted about 40% of the light output. The new luminaires provide twice as much light on the pavement as the old fixtures. With a reduction in street lighting rates, there will be no increase in the budget for the new lighting arrangement.

Sewage Plant Operation in New York City

Treating New York City's sewage is a major task. During 1949, an average of 452 mgd was treated—325 mgd by activated sludge, 57 mgd by chemical precipitation, 44 mgd by plain sedimentation, and 26 mgd by fine screening. Sludge amounted to 173,200 cu. ft. per day. Every day 1,179,500 cu. ft. of sludge gas were used for power and heat. The cost of treatment was $17.71 per mg; and $27.37 per ton of dry solids removed.

Minneapolis Builds Large Water Line

A 48-inch steel water main 19.5 miles long is being laid to serve the rapidly growing suburban districts of Minneapolis. The work is being done by the City Engineering Department, using city equipment. Two Buckeye Model 70 cranes do the trenching and also handle the 40-ft. sections of pipe into the trench. Dirt is usually handled but once, being loaded into Ford trucks equipped with St. Paul 5-yd. heavy duty pump bodies having half-hinged sides, and immediately being hauled to the finished pipe line for backfill.

When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

PUBLIC WORKS DIGESTS

THE SEWERAGE AND REFUSE DIGEST

Sewage Treatment At Fresno, California

Fresno owns and operates a municipal farm of 1292 acres located about 5 mi. from the city, which is also the site of a recently installed primary sewage treatment plant. Of the farm, 600 acres are in grass pasture, 190 planted to kaffir corn, 90 to Sudan grass, 65 to alfalfa; 305 is in lagoons, and 43 is yards, etc. There are over 600 head of fine cattle on the farm. In the fiscal year ending June 30, 1949, the total operating cost and expense of the farm and treatment plant was $46,001, and the total cash income of the farm and plant for the same period was $55,347. With enlargement of the cropping area it is entirely possible that the operating profit will in the future pay a substantial rate of interest on the capital investment.

A. Segel—"Sewage Reclamation at Fresno, California;" *Sewage and Industrial Wastes*, August.

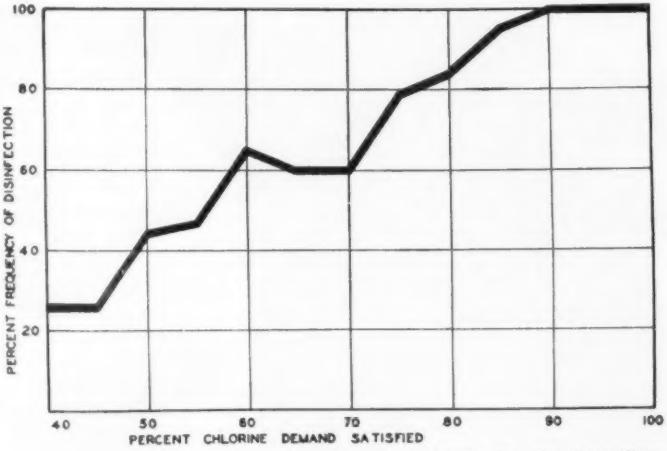
Sewage Laboratories

In planning a sewage treatment plant, provide a laboratory and furniture, but let the chemist who will operate the plant select the equipment, glassware and reagents, having all ready for service before the plant is put into operation. All the laboratory windows should face north. It is desirable that the lighting fixtures be tubular ones parallel to ceiling cove above the windows. Stone tops on laboratory benches break glassware—wood finished with asphalt varnish is preferable. Do not put radiators under or close to the bench. Water and gas pipes and electric wires, carried under the full length of the bench and tapped for connections at 4-ft. intervals, is a convenient arrangement. The fume hood is best located adjacent to the bench and provided with plenty of water, and with a sliding, counterpoised front sash with wire-reinforced glass panels. If bacteriological work is to be done, there should be two incubators, one for this, the other for B.O.D. determinations. The refrigerator should be large enough to hold all samples taken during 60 hrs. A water still of 1 gal. per hr. capacity is sufficient. For keeping bulk chemicals and pure reagent there should be a storeroom, closed to daylight and with temperature reasonably constant. Other appliances include an electrically driven combination blower and vacuum pump to produce at least 20" of vacuum; a drying oven; and a fire extinguisher using dry carbon dioxide.

Earl Benning—"Planning the Sewage Laboratory;" *PUBLIC WORKS*, September.

Subresidual Chlorination

At Los Angeles' Hyperion plant, chlorine is added to the plant effluent at the rate of 2,000 lb. per hr., but even so, a residual cannot be attained at all times, and for 10 hr. of the day subresidual chlorination is practiced, 40% to 100% of the chlorine demand being satisfied. Data of the past three years show that a 40% satisfaction produces a reduction of bacteria in nearly every case, and disinfection in ¼ of the samples. When more than 85% of the chlorine demand is satisfied, a 99% reduction of bacteria is regularly obtained. The percentage destruction of bacteria is related not only to the fraction of the chlorine demand satisfied but also to the amount of chlorine added. When chlorine is added to sewage in increasing amounts, a succession of compounds of varying lethal potency is formed and inflection points are passed where the trend of reaction shifts from a lethal to a non-lethal type. Reaction trends are dictated by the chemical characteristics of the sewage. In some cases, reactions of the lethal type appear to be catalytically accelerated by substances that are incidentally present, for antibacterial action builds up rapidly. Such effluents can be disinfected by partial chlorination.



Courtesy Jour. Sew. & Ind. Wastes

● ***RELATION of chlorine demand satisfaction to percentage of disinfected samples.***

Wasteful hydroxylation reaction sequences may be reduced by careful control of chlorine dosage.

C. W. Beardsley—"Disinfection by Subresidual Chlorination;" *Sewage and Industrial Wastes;*" August.

Characteristics of Sewage-Wastes Mixtures

A survey was made by the New Jersey Agricultural Experiment Station of the character, quantity and behavior of individual wastes, and mixtures of these, that would be contributed by various major industries and municipalities to a projected trunk sewer in the Raritan River Valley in N. J., and of the effect of settled effluent from them on the salt water into which it would be discharged. The results showed that:

The pH values of the mixed wastes in the trunk sewer would not be less than 5.0, and might be as high as 5.9 in the lower section, provided that wastes with low pH values (as are most of the wastes) were neutralized to pH 4.0 before discharge into the sewer. It was estimated that the industrial wastes would contribute 75% of the flow, 61% of the B.O.D., 75% of equivalent population, and 68% of the suspended solids. Formation of suspended solids from materials in solution takes place as a result of interaction of various types of wastes. Sedimentation of the individual wastes showed an indicated over-all removal of 79% of suspended solids, whereas sedimentation of the mixtures gave an 89% removal, indicating the benefits derived from treatment of the wastes collectively as compared with individual treatment. The sludge solids were mostly inorganic and, accordingly, compacted and dewatered readily without the addition of chemicals. The mixed waste effluent after sedimentation did not manifest a rapid short-time oxygen demand. Substantially the same B.O.D. values were obtained with standard dilution water as with 1:1 diluted sea water. The mixed waste effluent had a tendency to give lower B.O.D. values with higher concentrations, indicating the presence of inhibitory substances. No appreciable after-flocculation of the settled effluent would occur when discharged into salt water.

Willem Rudolfs and H. Heukelekian—"Characteristics of Industrial Sewage in the Raritan River Valley;" *Sewage and Industrial Wastes,* August.

When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

BIBLIOGRAPHY

American City

Sewer-Service Charges for City-County Sewerage Project. By *A. R. Vollmer*, Cons. Engr. September, Pp. 98-99, 171.

Waterloo's Garbage Program Is Tops in Iowa. By *Carl Fagerlind*, Street Supt. September, Pp. 104-105.

Transfer Station Expedites Refuse Handling. By *W. A. Xanten*, Supt. Div. of Sanitation, Washington, D. C. September, Pp. 108-109, 169.

Civil Engineering

Interstate Commission Tackles Pollution Problem in Ohio River Valley. By *Edward J. Cleary*, Chf. Engr. Ohio Valley Water San. Com'n. August, Pp. 32-34.

Comprehensive Plant Survey Simplifies Problem of Industrial Waste Disposal. By *Frank W. Jones*, Cons. Engr. August, Pp. 34-35.

Engineering News-Record

Refuse Transfer Is Odorless and Dustless. Sept. 7, Pp. 35-37.

Maryland-Delaware Water & Sewerage Ass'n. Journal

Pollution Studies of Baltimore Harbor. By *Chesley F. Garland*, Research Assoc., Johns Hopkins Univ. Year of 1950. Pp. 29-41.

Baltimore's Design of Small Sewers. By *Bernard F. Sunwall*, Prin. Assoc. Eng., Bureau of Sewers. Year of 1950. Pp. 49-52.

Municipal Engineering (England)

Plant Control: Simple Tests Can Be Effective, Sept. 1, Pp. 98-99.

Tipping Refuse into Water-Filled Pits. Sept. 1, P. 99.

Public Works

Designing Sewers for the Sub-Arctic. September, P. 44.

Planning the Sewage Laboratory. By *Earl Benning*. September, Pp. 50-52, 56-57.

Sewage and Industrial Wastes

Sludge Dewatering and Disposal. By *Samuel J. Zack*, San. Engr. August, Pp. 975-994.

Vacuum and Cord Filtration. By *Paul O. Richter*, Eimco Corp. August, Pp. 994-996.

Heat Drying of Sludge. By *Robert D. Nickerson*, Flash Dryer Div., Combustion Eng. Superheater, Inc. August, P. 996.

Wards Island Plant Capacity Increased by Structural Changes. By *Richard H. Gould*, Director, Div. of Sew. Disp., N. Y. City. August, Pp. 997-1003.

Disinfection by Subresidual Chlorination. By *C. W. Beardsley*, Testing Engr., Dept. of Pub. Wks., Los Angeles, Calif. August, Pp. 1004-1012.

Sewage Reclamation at Melbourne, Australia. By *Charles Gilman Hyde*, Cons. Engr., Berkeley, Calif. August, Pp. 1013-1015.

Characteristics of Industrial Sewage in the Raritan River Valley. By *Willem Rudolfs* and *H. Heukelekian*, Rutgers Univ. August, Pp. 1016-1023.

Significant Characteristics of Sewage and Industrial Wastes. By *John T. Norgaard*, San. Engr. August, Pp. 1024-1033.

High-Rate Anaerobic Digestion of Industrial Wastes. By *Harry W. Gehm* and *Vaughn C. Behn*, Nat'l. Council for Stream Improvement. August, Pp. 1034-1040.

Milk Waste Treatment by Aeration. By *Frank K. McKee*, San. Engr. Kraft Foods Co. August, Pp. 1041-1046.

Federal Industrial Pollution Studies. By *Hayse H. Black*, U.S.P.H.S. August, Pp. 1049-1053.

Simplified Dissolved Oxygen Computations. By *M. Le Bosquet, Jr.* and *E. T. Tsivoglou*, San. Engr., U.S.P.H.S. August, Pp. 1054-1061.

Aquatic Weed Control with Sodium Arsenite. By *Kenneth M. Mackenthun*, Biologist, State Bd. of Health, Wis. August, Pp. 1062-1069.

The Effect of Industrial Wastes on Sewage Treatment at Topeka, Kansas. By *D. B. Kissinger*, Supt. of Sew. Treatment. August, Pp. 1070-1072.

Handling Radioactive Wastes in Sewers. By *John D. Parkhurst*, Res. Engr., Los Angeles Co. San. Dist. August, Pp. 1073-1076.

Safety at Sewage Treatment Plants. By *Gordon E. Mau*, San. Engr., State Bd. of Health, Kans. August, Pp. 1080-1084.

Sewage and Industrial Wastes Engineering

Operating an Industry's Activated Sludge Plant. September, Pp. 458-460, 484.
Industrial Wastes Research on the March. By *V. M. Ehlers*, Chf. Engr., Texas State Dept. of Health. September, Pp. 461-462, 484.
Tips on Sewage Works Design and Operation. By *LeRoy W. Van Kleeck*, Prin. San. Engr. Conn. Dept. of Health. September, Pp. 463-465.
Effect of Organic Compounds on Biochemical Oxygen Demand. By *H. Gladys Swope* and *Marita Kenna*, Allegheny Co. San. Authority. September, Pp. 467-468.
Animal Hide Glue Plant Treats Waste Waters, Recovers Grease. September, Pp. 469, 484.

The Surveyor (England)

Small Private Septic Tanks. By *L. B. Escritt*. Aug. 25. Pp. 491-492.

How Cities Save Money

(*Continued from page 44*)

treatment. The city has completed a 4 mgd high rate filter for sewage treatment. Roberts & Merriman of Lubbock were engineers. In San Benito, Tex., F. A. Vaughn, City Manager, found a crawler tractor with front end loader most effective on the sanitary fill, and a motor street sweeper for keeping the city clean.

James S. Hughes, Town Manager, Farmville, Va., writes of rebuilding four blocks of streets. In addition to widening, 15 trees up to 36 ins. in diameter were removed. The tops were cut out and a trench hoe used to dig around the roots. A 10-ton winch on the front of a truck pulled out the stumps and the trench hoe loaded them into trucks for removal. The same equipment was used to load dirt for fill, load materials, pull a scarifier, tear up the old sidewalk, handle the broken concrete into trucks, load the new material for the subgrade, dig out services and utility lines for replacement, and do other work. This most useful unit is a truck-mounted shovel with a trench hoe attachment.

How a front end loader helped in street widening is reported by Herbert West, City Engineer of Suffolk, Va., who says: "A grader and the front end loader were used for subgrading; steel forms were used for curb, gutter and sidewalk; the front end loader was used to remove power pole stumps and tree stumps, which it did with very little effort and small cost. The front end loader is the finest piece of equipment ever designed for city work. Our first one paid for itself in labor savings within a period of ten months." Wytheville, Va., C. W. Beamer, Town Manager, used a half-yard shovel with backhoe attachment on water and sewer trenching and quarry stripping.

G. D. LeGro, City Engineer of Mt. Vernon, Wash., used a tailgate spreader for salting the streets and found it highly economical. In Renton, Wash., B. M. McHugh, City Engineer, reports that a power shovel was used to dig a trench 11 ft. deep, handle 20-inch pipe into the trench and then backfill it. The pipe was in 11-ft. sections.

In Beckley, W. Va., William Larew, Recorder, a small bituminous spreader and a 10-ton roller were most effective in a street blacktopping program.

I. V. Akkerson, City Engineer of Beaver Dam, Wisc., says that regular street maintenance was greatly improved by use of a soil mixer and pulverizer. Greendale, Wisc., R. J. Eppley, Jr., Village Manager, dug culverts with a front end loader on a wheel tractor; this equipment was also used for street repair and on sewer work. In Rice Lake, Wisc., R. G. Cooper, Engineer, reports that a truck mounted crane was effective in removing old curb and sidewalk; and that the use of steel curb, gutter and sidewalk forms reduced construction cost.

When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

Water and Sewerage for Subdivisions

(*Continued from page* 41)

lots he is required to put in his deed, or contract of sale, a statement to the effect that the arrangements for water supply and sewage disposal must be installed in accordance with the plans approved by the New York State Department of Health.

Sewerage Data

Alabama, Arkansas, Maryland and North Carolina encourage community sewerage systems, where the project is to be owned and operated by a responsible authority. In Florida, Michigan, and West Virginia there is no assurance that a developer will continue to operate a central sewerage system after it is constructed.

In Kansas, septic tanks are discouraged, since, according to Metzler, "almost without exception septic tank systems in urban areas break down after several years of use and nuisances develop which are often difficult if not impossible to correct without a public sewer system."

The local communities of Connecticut are permitted to adopt ordinances to prohibit the construction of houses unless sewage disposal facilities have been approved by a duly designated local agency.

North Carolina does not place any restrictions on the sale of lots to individuals for development, but instead holds the person who develops the lots responsible for providing satisfactory sewage disposal facilities; the same is true in Alabama.

Suggested Solutions

Clarkson, of Georgia, suggests that a permit be required before platting or laying out any land for a subdivision. He also suggests the promotion of local planning or zoning commissions. In larger populations, this would involve a local planning commission depending upon and cooperating with the local health department; in smaller populations the planning and zoning could be vested in the health department.

Hubbard, of North Carolina, states "that a subdivision law having specific application to matters pertaining to water supply and sewage disposal facilities would be a definite advantage and would aid us considerably in obtaining satisfac-

tory facilities to serve both existing and new subdivisions." Gidley, of West Virginia, feels that persuasion of the county commissioners to assume jurisdiction over sewer systems in rural subdivisions would be of material help.

The following is taken from "Regulations Governing Subdivisions of Land", Jackson County, Mo.: "Lot Sizes—Minimum dimensions for residential lots shall be 60 feet in width measured on building lines and not less than 125 feet in depth, unless the Commission, for special reasons, approves otherwise. No rectangular or irregularly shaped lot shall contain less than 7,500-square feet unless the Commission approves otherwise. "Water and Sewers—The Commission may refuse to approve a plot unless it is evident that proper water and sewerage facilities can be supplied within a reasonable time."

In the Utah State Department of Health Specifications for the Installation of Private Sewage Disposal Units, the following appears: "Subdivisions will be approved for individual sewage disposal only upon presentation of a subdivision plan which indicates compliance with all requirements on every lot. Such plan must include ground contours at 1-foot or 2-foot intervals, or suitable spot elevations from which ground slope for each lot can be determined. Cesspools will not be approved. Basement floor drainage must be discharged into the septic tank through an automatic electric sump pump. No part of any sewage disposal unit shall be placed closer than 50 feet to a well, and due consideration must be given to ground slope in selecting the location of such units relative to well location."

In Maryland, the boards of county commissioners are being urged to take advantage of the law which provides for establishing municipal planning and zoning commissions in any county or municipality in the State having a population of more than 10,000 inhabitants. Progress thus far has been quite slow. When this State-wide law was passed 11 of the 23 counties and Baltimore City were exempt as well as the Maryland-Washington Metropolitan District in which the Maryland-National Park and Planning Commission has jurisdiction. In those counties where planning and zoning boards have been established the control of subdivisions and the installation of adequate water supply and sewerage facilities

This directory continued on Page 110

where public systems are not available, is very satisfactory.

As many of the subdivisions in the Maryland area are not financed through the Federal Housing Authority or the Veteran's Administration additional control is desirable.

Adequate control over the installation of sanitary facilities in new real estate subdivisions remote from public sanitary facilities appears to be lacking in many states. There is a definite need for such laws with provisions for efficient enforcement of them. Until such laws are provided the most effective control, at present, seems to lie in cooperation between the Federal Housing Administration, the Veteran's Administration and the state departments of health. This cooperative arrangement, however, relates only to those developments which are financed through these federal agencies. Better control over subdivisions could be accomplished through the establishment of county (or their equivalent) planning and zoning agencies acting in cooperation with the state and local health departments.

UNC Installs 10,000 KW Turbine Generator

To furnish electricity and to heat campus buildings, the University of North Carolina, Chapel Hill, will install a 10,000 kw 80% power factor, 3-phase 60-cycle, 6,900-volt Worthington turbine generator. This turbine is to take steam at 400 lbs. pressure, 750°F total temperature and to exhaust a 2½-inch absolute. It is a bleeder type turbine and is designed to bleed any or all steam up to approximately 178,000 pounds per hour at 25 pounds pressure. This bleed steam is to be used for heating campus buildings. Shipment of the unit will be made in April, 1951. W. C. Olsen, Raleigh, is consulting engineer.

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236. A new 8-page bulletin (No. 5037) is available which offers a clear description of alkalinity control by blending sodium and hydrogen zeolite softened waters, and shows the advantages of this treatment for industrial and municipal applications. Included are flow diagrams and discussion of the chemical reactions. Use coupon for your copy. General Filter Co., Ames, Iowa.

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237. Sewers, culverts and other drainage structures required to withstand severe conditions must have structural strength and material durability to protect your investment. Be sure to investigate Armco Asbestos-Bonded Pipe when faced with corrosive wastes and soils; long spans or high loads. Use coupon to get Folder AB 3250 and see how Armco products can help you. Armco Drainage and Metal Products, Inc., Middletown, Ohio.

How Vacuum Cleaning Empties Catch Basins

238. Investigate the "Karrier-Yorkshire" which vacuum cleans catch basins; separates solids from dirty water; returns water to the sewer. Simple accessories adapt this machine for street flushing. Use coupon for fully illustrated data and complete specifications. Rootes Motors, Inc., 11 Bridge Plaza North, Long Island City 1, N. Y.

Automatic Pump Control For Your Water System

239. In Bulletin 230-G4, Builders-Providence outlines the "Pressurefio Control" system which is said to save on first cost by providing ground level storage in residential areas; permit unattended operation of outlying stations; furnish instantaneous response to meet fire flow. Flow diagrams and typical applications are included. Mail coupon to check this versatile system. Builders-Providence, Inc., Providence 1, R. I.

Plant Layouts for Installations

240. Catalog M-1, offered by Washburn-Granger, shows typical incinerator plant layouts engineered expressly to make use of modern design and equipment. A great help for the designer. Use the coupon for free copy. Washburn & Granger, Inc., 53 Park Place, New York 7, N. Y.

Vacuum Filters Feature Easy, Non-Clog Operation

241. Get full data on vacuum filters using double layers of continuous coil springs that insure continuous, non-clog operation for sewage sludge dewatering. Coils are automatically cleaned at each revolution. Komline-Sanderson Engineering Corp., Peapack, N. J.

Full Line of Plows Meets All Snow Removal Needs

242. Data issued by the Gledhill Co. covers the 22 standard snow plows available to meet all snow removal needs. Safety trip, foldback hoist and interchangeability are featured. Write Gledhill Road Machinery Co., Galion, Ohio, or use coupon.

City-Wide Planning for Dual Waste Disposal

243. You can get full details on the General Electric "Disposall" plan for garbage elimination by converting food wastes to sewage. Learn how Jasper, Ind., eliminated garbage cans and collection nuisance with electrical disposal units by checking handy coupon. General Electric Co., Bridgeport 2, Conn.

Special Equipment for Complete Pavement Testing

244. 28 pages of the new Central Scientific Co. catalog is devoted to equipment especially designed for all tests of paving materials, including aggregates, concrete, bituminous materials, subgrade soils, etc. This catalog is a must wherever pavement tests are made. Use coupon for copy. Central Scientific Co., Chicago 13, Ill.

Sanivan Features Faster Refuse Loading, Greater Capacity

245. The compression loading plate on the Sicard Sanivan crushes ordinary loose refuse into one-third original space. For clear cutaway views of this positive compression action and mechanical full discharge, get the Sanivan bulletin by using coupon. Sicard Industries, Inc., 2055 Bennett Ave., Montreal 4, Canada.

"Silent Hoist" Equipment for Public Utilities

246. The complete line of Silent Hoist winches for trucks and tractors, "Krane Kars" with orange-peel and clamshell buckets and other equipment of interest to municipalities are illustrated in bulletin 54. Use coupon for copy, or write to Silent Hoist & Crane Co., 844 63rd St., Brooklyn 20, N. Y.

SEWERAGE AND WASTE TREATMENT

Something Different! "Pipe Dreams" Full of Fun and Good Sense

22. The Universal Concrete Pipe Company will be glad to send you regular issues of "Pipe Dreams", their delightful pocket-size magazine full of American philosophy and good cheer. No cost or obligation. Just write Universal Concrete Pipe Company, Dept. PW, 297 South High St., Columbus 15, Ohio.

Design of Septic Tanks When Using Home Garbage Grinders

26. The use of a Youngstown Kitchens food waste disposer with a septic tank is thoroughly discussed in a new booklet released by Mullins Mfg. Corp. Tables show tank sizes for new construction, recommendations are made for improvements and better operation of existing systems, and a wealth of other valuable information is provided. For a free copy use coupon or write to Mullins Mfg. Corp., Dept. PW, Warren, Ohio.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass.

A Handbook of Sewer Cleaning Equipment and Methods

46. A new, fully illustrated 40-page booklet shows every sewer cleaning operation with "Flexible" tools. Includes data on the fast and easily operated new Sewe RodeR and full engineers' specifications for power bucket machines. For your copy write Flexible Sewer Rod Equipment Co., 9059 Venice Blvd., Los Angeles 34, Calif.

How You Can Dispose Of Sewage Solids

54. Nichols Herresboff incinerator for complete disposal of sewage solids and industrial wastes—a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Dept. PW, Nichols Engineering and Research Corp., 70 Pine St., New York 5, N. Y.

Improved Clarification with Carter Circular Collectors

61. Latest 16-page bulletin on water and sewage equipment, No. 4906, gives complete

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310 East 45th Street, New York 17, N. Y.

Please send me the following literature listed in the Reader's Service Dept. of your October issue.

Booklets from pages 111-115:

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data and specifications on Carter's three different types of clarifiers. A valuable working guide for every sanitary engineer. Ralph B. Carter Co., Dept. PW, 188 Atlantic Ave., Hackensack, N. J.

Sewage Plant Gas Storage Facilities

62. General information on estimating figures on Hortonspheres to store surplus gas produced in digesters at sewage disposal plants supplied by Chicago Bridge & Iron Company, 2115 McCormick Bldg., Chicago 4, Ill. Hortonspheres are built in sizes up to 65 ft. diameter for pressures as high as 60 pounds per sq. in. for storage at sewage plants utilizing digester gas.

Standard Forms for Concrete Pipe

67. Concrete pipe for sewerage, drainage and culvert projects can be produced quickly and uniformly with Quinn Standard concrete forms. Data on forms for 12" to 84" tongue and groove or bell end reinforced pipe from Quinn Wire and Iron Works, 1621 12th St., Boone, Iowa.

Recording Meters for Parabolic Flumes

73. Engineering data on parabolic flumes and accurate companion meters for open flow water and sewage metering is given in Simplex bulletin 210. Installation data and calibration included. Write Simplex Valve and Meter Co. Dept. 4, 6750 Upland St., Philadelphia 42, Pa.

Odorless Sanitary Septic Tank Cleaning

88. The Gorman-Rupp Odorless Sanitary Cleaning unit combines centrifugal self-priming pump, air-cooled engine and oval tank on a sturdy frame. For full description of this adaptable unit get bulletin 7-ST-11. Gorman-Rupp Co., 120 N. Bowman Ave., Mansfield, Ohio.

How Cities Can Do Complete Sewer Cleaning From Street

98. Literature illustrating how cities, towns and villages using OK Champion Sewer Cleaners are doing a complete sewer cleaning job from street level. Power machines available in addition to full line of sewer rods and accessories. Issued by Champion Corporation, 4752 Sheffield Avenue, Hammond, Indiana

Useful Data on Butterfly Valves

100. Complete descriptions and tables of dimensions on the full line of Rockwell Butterfly Valves is contained in several bulletins published by the company. Construction details and special control features are illustrated. Write W. S. Rockwell Co., 200 Eliot Street, Fairfield, Conn

Complete Catalog for Engineers Shows Sewage Plant Equipment

110. A complete, 44-page catalog gives engineering data on Jeffrey equipment for water, sewage and industrial waste treatment plants including screening, screenings grinders, grit collectors and washers, settling tank collectors, feeders, Flectrols, mixers and other mechanical equipment. Use coupon to get Catalog 775-A, Jeffrey Mfg. Co., Columbus 16, Ohio.

How to Improve Coagulation and Sludge Conditioning

111. "Ferri-Floc," description and instructions for use in coagulation, sludge conditioning and treating industrial wastes, fully treated in a 24-page pamphlet. Tennessee Corp., 619-27 Grant Bldg., Atlanta 1, Ga.

Underdrains—Hidden But Important Filter Components

113. For filter bottoms this firm makes "Armcre" vitrified salt glazed floor blocks which provide ducts occupying 50% of the floor cross-section and air openings aggregating over 24% of the floor area. Described in several leaflets and data sheets. Ayer-McCarel-Reagan Clay Co., Brazil, Ind.

Need Low-Cost Air For Sewage Treatment?

122. New 20-page booklet shows operating and construction features of Rotary Positive Blowers engineered to fit your needs. Air for activated sludge, water treatment, constant vacuum for filtering. Bulletin 22-23-B-13 gives details. Roots-Connersville Blower Corp., 508 Poplar Ave., Connersville, Ind.

Standard Translot Blocks For Filter Underdrains

145. Proper filter underdrainage is extremely important. Specifications and installation details for transverse slot filter underdrains made of durable vitrified clay are available from Texas Vitrified Pipe Co., Mineral Wells, Texas.

Data on New Single Stage Sludge Digestion Unit

163. High capacity mixing and ample gas storage space are provided in the new single stage digester type MA. Bulletin No. 6591 describes the unit and tells how it works. Photographs, drawings and useful tables of sizes and design data are included. Unit is available for tanks from 20 to 50 foot diameters. The Dorr Co., Barry Pl., Stamford, Conn.

Fabrication with Everdur For Long-Range Economy

169. Corrosion-resistant Everdur alloys are available in all wrought commercial shapes suited for dozens of applications in water and sewage plants. Many examples shown in Publication E-11 issued by The American Brass Co., Waterbury 20, Conn.

Conkey Filters for Sewage Sludge Disposal

180. Development of Conkey sludge filters and applications to all types of sewage sludge are described in Bulletin 100. Tables show filter sizes, weights, and give average anticipated results. Write General American Transportation Corp., Process Equip. Div., 10 East 49th St., New York 17, N. Y.

The Vacuum Filter In Your Home Town

182. That is the title of bulletin F-2005 issued by The Eimco Corp. Data on dewatering sewage sludge by actual installations are included. Write Eimco Corp., Salt Lake City 8, Utah.

Air for Activated Sludge and Other Aeration Processes

187. Quiet operation, high efficiency and compact size are features of the Chicago "Standardaire" positive displacement blower. Wide range of capacities available to fit your needs. Details and performance data from Chicago Pump Co., 2348 Wolfram Ave., Chicago 18, Ill.

Where You Can Use Air-Entrained Concrete

221. Atlas Duraplastic air-entraining portland cement has been chosen for all types of concrete structures because it is more workable, more durable, more uniform. Bulletins of the Universal Atlas Cement Co., 135 East 42nd St., New York 17, N. Y. describe its many applications and advantages.

Vacuum Filter Design Data

223. Typical flow diagrams, details of operation, power requirements and standard sizes of individual units and "package" units of the Oliver Sewage Sludge Dewaterer are presented in Bulletin 219. Check coupon for your copy. Oliver United Filters, Inc., 33 W. 42nd St., New York, N. Y.

How to Estimate Quantity Of Joint Compound Needed

229. Directions for using Atlas G-K Sewer Joint Compound plus a handy table quantity of compound and jute required per joint of sewer pipe are presented in Bulletin M20-1. Get full data on this permanent joint material from Atlas Mineral Products Co., 10 Pine St., Mertztown, Pa., or use coupon.

REFUSE COLLECTION AND DISPOSAL

How the Mobil-Sweeper Can Improve Street Sweeping

23. Sweeping costs can be cut with the new Mobil-Sweeper which features safe highway speeds up to 55 mph, carries 2 2/3 cu. yd. dirt hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to The Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif. or use coupon for complete details on this machine.

When you need special information—consult READERS' SERVICE DEPT. on page 111-115.

How to Lower Costs Of Refuse Collection

35. For saving trucks, labor and time in city rubbish collection get details of the new Dumpster-Kolector described in literature just published by Dempster Bros., Inc., 980 Dempster Bldg., Knoxville 17, Tenn.

Folders Tell "Inside" Story Of Crawler Tractors

108. Performance-boosting and cost-cutting features of International crawler tractors are graphically presented in two new folders issued by International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Titles are "How Long is Your Tractor's Life Line" and "Is Your Horsepower Getting to the Track?".

International Trucks Are Built to Take It

120. Trucks take a pounding in construction work—that's why you need data on International Trucks that are engineered for your job. Check the coupon or write International Trucks, Dept. PW, 180 N. Michigan Ave., Chicago 1, Ill.

An Incinerator Necessity

215. Recuperators featuring individual replacement of the heat transfer elements (silicon carbide tubes) for maximum accessibility and efficiency are described and illustrated in Bulletin 11 issued by Fitch Recuperator Co., Dept. PW, Plainfield Nat'l Bank Bldg., Plainfield, N. J.

For Speedy, Nuisance-Free Refuse Collection

247. Refuse collection. The Gar Wood "Load Packer" compresses the refuse into the front of the collecting body, thus greatly increasing its capacity. Made in 9, 12 and 15-yd. capacities. Described in several bulletins of Gar Wood Industries, Inc., Wayne Div., Wayne, Mich.

STREETS AND HIGHWAYS

How to Select the Proper Sno-Plow for Your Truck

21. Fully illustrated 24-page catalog on Frink Sno-Plows includes valuable tables on proper plow and leveling wing selection for mounting on all size trucks. Detailed discussions cover special features which result in performance plus economy. Use coupon for copy. Frink Sno-Plows, Inc., Clayton, 1000 Islands, N. Y.

Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walls and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a new bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 10, Wis.

Latest Maintenance Equipment for Blacktop Roads

52. "Blacktop Road Maintenance and Construction Equipment"—Asphalt and tar kettles, flue type kettles, spray attachments, tool heaters, surface heaters, road brooms and rollers. This is modern and up-to-date equipment for blacktop airport and road construction and maintenance. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, Ohio.

Municipalities Make Equipment Dollars Go Further

55. Be sure to get your copy of "Saving Facts" a new illustrated booklet prepared by The Oliver Corp. that shows how equipment dollars can be stretched on municipal work. Text and photos describe the application of tractors and money-saving attachments in street maintenance, snow removal, waste disposal, pipe laying and other projects. Write The Oliver Corp., Industrial Div., 19300 Euclid Ave., Cleveland 17, Ohio.

Chemical Stops Salt Corrosion

174. A new chemical has been developed which, when mixed 1 pound to 100 pounds of salt, prevents any corrosion of automobiles by the salt. Harmless; colorless; odorless. Permits free use of salt for ice and snow control without complaint by drivers. Calgon, Inc., Pittsburgh, Pa.

Heating, Thawing and Melting With Hauck Burner Equipment

142. A newly released 16-page bulletin covers the complete line of Hauck heating and melting equipment. Data covers units for every water, sewer and street department purpose, from "one-man" burners to large size portable kettles. A useful addition to your reference file. Get Bulletin 1068 from Hauck Mfg. Co., 117-127 Tenth St., Brooklyn 15, N. Y.

Road Widening With Concrete, Bituminous Mix or Gravel

149. All types of road building materials are handled quickly and accurately by Apsco Wideners. New illustrated bulletin shows operations on all types of widening strips, gives details on wideners and trench rollers. Issued by All Purpose Spreader Co., Elyria, Ohio.

Versatile Maintainer Has Year 'Round Usefulness

151. A new bulletin shows how the sturdy Huber Maintainer will work for you the year 'round on maintenance jobs, berm leveling, road planing, bull-dozing, snow plowing, brooming, mowing shoulders and as a patch roller. Good ideas on how to do all these jobs in Bulletin No. M-138. Write Huber Manufacturing Co., Dept. PW, Marion, Ohio.

Thrifty Salt Spreader for Snow and Ice Control

248. Check the Tarco "Scotchman" for fast, thrifty salt application to icy roads. Stainless steel spreader has weatherproofed engine. Get all data from Tarrant Mfg. Co., Jumel St., Saratoga Springs, N. Y.

End Dangerous Ice Hazards

179. Ice prevention on highways, streets and airport runways with Sterling "Auger Action" rock salt is described in illustrated bulletin PW issued by International Salt Co., Inc., Scranton, Pa.

Helpful "How To Use" Section Aids Roller Selection

195. In addition to specification and illustrations of roller operation, the new Buffalo-Springfield catalog features a special section to help in the selection of the right roller model for the job. Be sure you get top results from your roller selection by checking this helpful material. Use the coupon for a copy. Buffalo-Springfield Roller Co., Springfield, Ohio.

The Easier Way For Pavement Breaking

220. Rapid Pavement breaking the low cost way is described in bulletins issued by the R.P.B. Corp., 2751 East 11th St., Los Angeles, Calif. Both "Mighty Midget" and heavy-duty truck-mounted models make quick, clean cuts, break trench openings or tamp backfill. Use coupon for full data.

WATER WORKS

Makes Underground Pipe Installations Easy

25. One-man operated Hydraulic Pipe Pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts and prices, ask for booklet S-117. Greenlee Tool Co., Dept. PW, 2048 Twelfth St., Rockford, Ill.

Is Your City Metered 100%?

33. 100% metering as practiced by many cities requires accurate, dependable meters with interchangeable parts. Cut-away views of every part, capacity and size data are all included in handsome American-Niagara water meter booklet available from Buffalo Meter Co., 2920 Main St., Buffalo 14, N. Y.

Cast Iron Pipe and Fittings For Every Need

65. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Dept. PW, Burlington, N. J.

All Electric Floatless Liquid Level Control

78. Description of operating principles and applications of B/W controls shows the simplicity and many uses of these all-electric, floatless devices. Diagrams of typical installations and engineering data all in bulletin 147 issued by B/W Controller Corp., Dept. PW, Birmingham, Mich.

Now You Can Actually See Your Chlorine Residual

79. By using the Wallace & Tiernan residual chlorine recorder you can get better chlorination control because you actually see at all times the residual being carried. The 24-hour charts provide a valuable record and check on operating irregularities. More data on what the recorder is and what it does are covered in Bulletin M-20-S. Wallace & Tiernan, Dept. PW, Newark 1, N. J.

Job Data Offered on New Steel Water Lines

80. A 12-page illustrated report listing pipe diameters, pipe wall thicknesses, line pressures, coatings, engineering personnel, etc., is entitled "A Report of Dresser-Coupled Steel Water Lines in the Year 1948." A copy will be sent by Dresser Mfg. Div., 59 Fisher Ave., Bradford, Pa.

Just Press the Button— It Does the Rest

103. Automatic Filter Operation. The Robotrol automatically back washes, rewashes and returns the filter to service. Illustrated Engineering Bulletin 1230. Infilco Inc., P.O. Box 5033, Tucson, Ariz.

Pressure Pipe That Retains Capacity

106. Several bulletins describing the construction of pressure pipe, list of installations, carrying capacity tests, making service connections under pressure, and detail descriptions of several installations. Lock Joint Pipe Co., Box 269, East Orange, N. J.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.

Get This Data for Your Laboratory

119. "Water and Sewage Analysis," a 32-page booklet, describes and illustrates equipment for making convenient and accurate water and sewage analyses, including comparators, aqua testers and turbidimeters. Hellige, Inc., 3718 Northern Blvd., Long Island City 1, N. Y.

Do You Ever Have Leaks to Fix?

124. You'll want to know about the full line of "Skinner-Seal" clamps for repairing bell and socket joint leaks and broken mains. Step-by-step procedures are illustrated in catalog 41, a handsome 40-page presentation which shows applications of all fittings. Write M. B. Skinner Co., Dept. PW, South Bend 21, Ind.

How Short Coupled Turbine Pumps Are Used

125. Ease of installation and dependable service make short coupled vertical turbine pumps particularly desirable for many municipal pumping jobs. Bulletin SCP-50 shows application of Layne pumps for lake and river intakes, fire pumps, drainage, pipe line boosters and many other uses. Check coupon for your copy of this valuable booklet. Layne & Bowler, Inc., Memphis 8, Tenn.

All About Cement-Mortar Lining of Water Mains

133. Here, in a really beautiful booklet, is practically everything you need to know about this method of lining mains in place—the needs, methods, and results that will interest you. Centriline Corp., Dept. PW, 140 Cedar St., New York 6, N. Y.

Faster Pipe Laying With Precaulked and Threaded Joints

148. McWane 2" cast iron water pipe with threaded joints and precaulked bell and spigot pipe are described in folder WM-47. Additional data on 3" to 12" centrifugally cast pipe and fittings in folder WL-47, both issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala.

Complete Equipment for The Complete Pool

157. Latest equipment for recirculation, filtration, chlorination, softening and pH control are described in Permutit Bulletin No. 2157. Manual and automatic valves explained and many installations diagrammed. Complete specifications given. Permitit Co., 330 West 42nd St., New York 18, N. Y.

Helpful Data on Corporation Stops

161. A complete line of brass goods for water works: corporation stops, curb stops, service pipe couplings, goosenecks and other fittings are illustrated and described in catalog W-39, issued by A. Y. McDonald Mfg. Co., Dubuque, Iowa. Get your copy for ready reference.

What You Should Know About Meter Setting and Testing Equipment

166. Complete details on all equipment and proper methods for meter testing and installation are included in an excellent book published by Ford Meter Box Co., Wabash, Ind. All waterworks men concerned with setting and testing of water meters should have a copy of this book. Write for Catalog No. 50.

Handy Catalog Covers All Pipe Repairs

167. A complete catalog covering repair clamps, packings and gaskets of several designs to suit all needs is offered by the Smith-Blair Co. Directions for use show ease of application. Every water works needs a copy of this catalog for ready reference. Available by using coupon or writing Smith-Blair, Inc., So. San Francisco, Calif.

Handy Calculator for Cast Iron Pipe

175. With the handy Cast Iron Pipe Calculator you can determine at a glance the class, weight and dimensions of bell and spigot pipe. This slide-rule type calculator is absolutely free. Use coupon or write R. D. Wood Company, Public Ledger Bldg., Philadelphia 5, Pa.

Your Property is Worth Good Protection

176. When installing link fence you want protection against rust and corrosion as well as vandalism. Investigate chain link fence made of "Konik" metal described in "Planned Protection" published by Continental Steel Corp., Kokomo, Ind.

Two-Way FM Radio Telephone Equipment for All Departments

197. The benefits of two-way radio communciation for all departments of municipalities and counties make full information on this subject important to all engineers. For descriptions of Motorola FM systems, or for specific recommendations concerning your application write to Dept. PW, Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.

Facts and Figures on Pumping Power

214. Diesel power for every kind of pumping service is discussed in "Pump Power", a new booklet issued by the Caterpillar Tractor Co. Included is data and illustrations on water supply and construction pumping with diesel power, as well as other uses of interest to city officials and construction men. Just check the coupon for your copy. Caterpillar Tractor Co., Peoria 8, Ill.

Here's Data on Fluoride To Combat Tooth Decay

223. Technical data for municipalities interested in the use of sodium fluoride for addition to water supplies is available from the General Chemical Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y. Information includes data from communities now using fluoride to reduce tooth decay.

Does Your Water Works Have Standby Power?

224. Dependable Climax power plants are ready for emergency service to insure fire protection, and can also save power costs by peak load operation. Use the coupon for full data on Climax, 40 to 495 HP, operating on sewage or natural gas, butane or gasoline. Climax Engine & Pump Mfg. Co., Clinton, Iowa.

Investigate This Compact Flow Meter for Water

226. The Foster "Flow Tube" is a new metering element that is compact and easy to install. Bulletin FT illustrates simple element containing nozzles for differential pressure production and shows capacity range and accuracy. Made in standard type sizes. Foster Engineering Co., Union, N. J. will send copy, or use coupon.

Helpful Data on Main Sterilization

231. This detailed discussion of main and emergency sterilization indicates standard procedure, shows how to calculate quantities of sterilizing solution, describes equipment and gives typical specifications. All calculations can be solved by use of a simple chart. Use coupon to get your copy of Bulletin SM-9365. Proportioneers, Inc., P. O. Box 1442, Providence 1, R. I.

CONSTRUCTION EQUIPMENT

How to Keep Trenching Jobs on Schedule

24. The easy maneuverability of the tough, compact Cleveland Model 93 "Baby Digger" makes it well suited for the difficult job of trenching past the many obstacles of city and suburban work. Multiple digging and crawler speeds handle all soil types and trench widths up to 24". Get Bulletin S-52 from Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

Data and Pictures of Complete Line of New Ford Trucks

58. Check this number on the coupon for colorful circular showing new Ford Trucks for every hauling need, available in great variety of standard, factory-built chassis and body combinations. Be sure to check these trucks on your job. Truck and Fleet Sales Dept., Ford Motor Co., Dearborn, Mich.

Tractors for Counties, Cities and Contractors

76. An attractive 24-page catalog portrays the Allis-Chalmers HD-5 crawler's abundant capacity and ability to meet the variable needs of counties, townships and contractors. Photographs and cutaway views illustrate its rugged construction and simplified maintenance. Use coupon or write Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee 1, Wisc.

Drill Concrete With Your Ordinary Electric Drill

82. Substantial cost-per-hole savings are claimed for Tilden Rotary Drills which penetrate concrete 2" to 4" per minute. Cutters can be reasharpened. Available in sizes ¾" to 4". Get full data from Tilden Tool Mfg. Co., 1995 N. Fair Oaks Ave., Pasadena 3, Calif.

Keep That Trench Pumped Really Dry!

93. To find out how well a Homelite Carryable Pump handles large volume, seepage, mud, write today for illustrated bulletin L-503 containing data of great value to all pump users. Write Dept. PW, Homelite Corp., 2110 Riverdale Ave., Port Chester, N. Y.

52-Page Data-Packed Bulletin On Contractors' Pumps

95. Tables for pump size determination on every excavation job, pipe friction loss, attitude effects and lots of other valuable data are included in this comprehensive booklet illustrating the many Jaeger "sure-prime" pump applications. Get your copy (catalog P45) by checking our coupon or writing the Jaeger Machine Co., Dept. PW, Columbus 16, Ohio.

Grading Can Be Faster, Cheaper and Easier

96. You'll like every feature of the Austin-Western 99H Grader. It has all-wheel drive, all-wheel steer, controlled traction, precision sideshift and a high lift, extreme reach, reversible blade. Get data from Austin-Western Co., Aurora, Ill.

Check "Gunite" Concrete For Every Application

158. Big 44-page book illustrates "Gunite" uses for both repair and new construction of sewers, tanks, dams, swimming pools, and all concrete structures. A multitude of applications. Be sure to check coupon or write Pressure Concrete Co., Dept. PW, 315 S. Court St., Florence, Ala.

Hydraulic Dump Bodies Feature Trouble-Free Hoist

165. Get data on Heil Twin-Arm hoists and bodies for 1½ to 2½ ton trucks and learn how reliable hoist and sturdy body will keep your truck in service with less repair and maintenance. Bulletin BH 4662-G gives details. The Heil Co., Dept. PW, 3000 W. Montana St., Milwaukee 1, Wisc.

POWER AND LIGHT

Using Sewage Sludge Gas For Power Generation

27. A new 8-page illustrated bulletin, No. 4811, describes Superior Dual Fuel Diesel engine operation and illustrates the simplicity of controls with fuel conversion by either push buttons or hand lever. Copies are available from Superior Engine Div., Dept. PW, The National Supply Co., Toledo, Ohio.

Air Cooled Engines for Hundreds of Applications

137. Tested under severest conditions of long, hard use, these engines have earned world wide recognition as the "right" power for hundreds of applications. Get latest bulletin from Dept. PW, Briggs and Stratton Corp., Milwaukee 1, Wisc.

Low Cost Power From Dual Fuel Engines

154. Operating on the Diesel cycle, burning either oil or gas, the Worthington Supercharged Dual Fuel Diesels give high economies by running on the cheapest fuel available. Get complete data from Worthington Pump & Machinery Corp., Dept. PW, Harrison, N. J.

INDEX OF ADVERTISEMENTS

PUBLIC WORKS EQUIPMENT News

35 to 700 GPM Sump Pump

To handle solid-bearing liquids, this sump pump is available in sizes from 1½ to 4-in., with capacities from 35 to 700 gpm, and for heads of 15 to 85 ft. The size of the solids is restricted by the strainer mesh opening of the pump, which is of the vertical centrifugal type. The pump is suspended from a circular support plate by a standard pipe column. Full data from Byron Jackson Co., Pump Division, Box 2017, Terminal Annex, Los Angeles 54, Calif.

Trailer Type Spreader for Highway Use

This new trailer-type spreader emphasizes operator safety while providing positive control of thickness, width and direction of spread. It is a self-contained unit that can be attached in a few minutes to any dump truck. The axle and differential provides power for both hopper agitator and spinner, discharging an even coating of sand, cinders, chips, lime, calcium or other materials from 8 ft. to 20 ft. wide, depending upon truck speed and fender setting. Thickness of the coating is regulated by a lever within easy reach of the operator. Width of spread and control of left side for oncoming traffic are accomplished by raising or lowering the directional fin. The operator is protected from the side and back by a curved basket-like steel guard. Hopper capacity about 2 cubic feet. Total weight including truck hitch is 410 lbs. For data, write Wausau Iron Works, Wausau, Wisc., or use the coupon.

Use coupon on page 111; No. 10-1

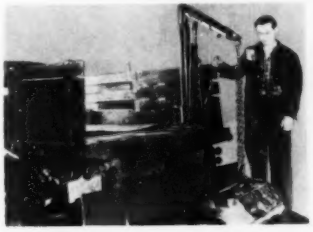
General Purpose Bituminous Distributor

Made in 600, 800 and 1,000-gallon capacities, for mounting on trucks 1½-ton and larger, this Model RHU bituminous distributor is intended for cities, counties and towns and for efficient handling of small jobs, such as road and street maintenance, secondary construction, parking areas and recreation areas. Good folder (No. S-170 A) will be sent on request to Rosco Mfg. Co., 3118 Snelling Ave., Minneapolis 6, Minn., or use the coupon.

Use coupon on page 111; No. 10-2

¾-Ton Truck and Shop Hoist

This hoist can be used on truck beds, floor frames, work benches or loading docks. It will lift 1,500 pounds 77¼ ins. in 45 seconds, and will handle up to a ton. The hydraulic pump is double action, hand operated. Placement on or removal from the truck is easy. When mounted on a truck, the boom will swing in a full circle. For more information, write Unit Mfg. Co., Minneapolis, Minn., or use the coupon.



¾ ton truck and shop hoist

Use coupon on page 111; No. 10-3

The Industrial Monkey

A new labor-saving machine designed to reach hard-to-get-at heights has been named the "industrial monkey." It consists of an extendable steel boom which can be mounted on any 1½-ton or larger truck. The boom can be extended to permit working at 40-ft. heights. The platform at the end of the boom is insulated against 8,000 volts and is adequately protected in other ways. The controls are hydraulic and can be operated from the truck or from the platform. Saving of 40% in tree trimming and of 50% in street light maintenance have been reported. An excellent booklet is available from Capital Industries, Inc., Portland 4, Oregon, or by using the coupon.

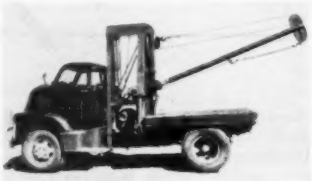
The monkey at work

Use coupon on page 111; No. 10-4

Part of assembly line in plant of Sicard Inc. at Watertown, N. Y. Here are made the modern Sanivan refuse collector bodies now in use in many important cities of the United States. The Sicard line includes flushers and rotary snow blowers.

Speeds Lifting—Saves Labor

Easily installed on any type of truck and used with any type of winch, the Hydra-Lift allows full use of the truck bed and is installed without any special tools or skills. It handles pipe, hydrants and valves; sewer pipe; blasting mats, heavy tools, curb sections, structural steel, road forms, and most any other of those heavy and bulky objects that take a lot of men and a lot of time to handle. Lifts 2,500 pounds at 20 ft.; more nearer at hand. Write Pitman Mfg. Co., 300 W 79th Terrace, Kansas City 2, Mo., or use the coupon.



Speeds heavy lifting work.

Use coupon on page 111; No. 10-5

Engine Driven Trailer Sweeper

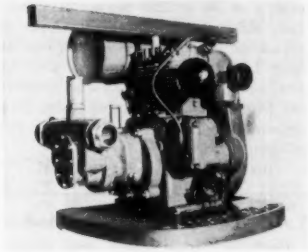
Designed for municipal, airport and road construction use, this sweeper is of the 3-wheel trailer type and is powered with a 15 hp aircooled engine. It is operated by one man and can be towed behind a car, truck or tractor. Brush is available in 6, 7, 8 or 9-ft. lengths. Details from Little Giant Products, Inc., Peoria, Ill., or by using the coupon.

Sweeper for many user.

Use coupon on page 111; No. 10-6

Pressure Testing & Chlorinating Water Mains

A portable pump, self contained, of the rotary positive displacement type, this unit is especially adapted for pressure testing and chlorinating water mains. It quickly develops pressures up to 200 pounds. It is easily carried and simple to operate. Power is furnished by a 4-cycle engine. This pump has many other uses, as well, and will furnish valuable service to a water or health de-



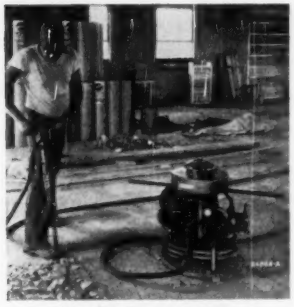
For testing and chlorinating water mains.

partment. For full data write Porto Pump, Inc., 227 Iron St., Detroit 7, Mich., or use the coupon.

Use coupon on page 111; No. 10-7

Light Weight 36-CFM Air Compressor

Weighing only 265 pounds, this compact gasoline driven air power unit is designed to do a great many of those small jobs in city and county work. A special wheelbarrow



Handy air compressor.

mounting enables one man to take the compressor and air tools almost anywhere. There are 3 horizontal power cylinders and 3 air cylinders. Delivery of air is 36 cfm at 80 psi, making it useful for operating a utility type air hammer and many other small tools. You can get full information from Ingersoll-Rand Co., 11 Broadway, New York 4, or use the coupon.

Use coupon on page 111; No. 10-8

Controlling Motor Speed for Power Take-Off Work

More economical and efficient operation of equipment powered by power take-offs from trucks, such as tail gate loaders, other loaders dump bodies, etc., is claimed to be possible by use of the "hydro-throttle control." This unit is installed, without special tools, on all makes of trucks having a power

take-off. Pressure from the take-off actuates the control. Thus, as pressure is increased to lift a load, the control speeds the engine to the power RPM, and immediately returns it to idling speed when the load is off. More information is available from Stratton Equipment Co., Hanna Bldg., Cleveland 15, O., or by using the coupon.

Use coupon on page 111; No. 10-9

Backfill Blade Attachment

A new backfill blade attachment is designed for interchangeable operation with the ⅜-yd. truck-mounted Schield Bantam trench hoe. It is reported by the manufac-

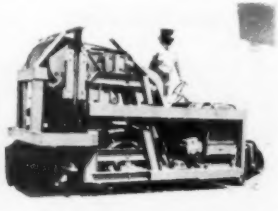
Backfill blade attachment.

turer that one of these shovels is being used to open 50 ft. of 20-inch by 42-inch gas main trench per hour; and that the backfill attachment permits backfilling at the average rate of 350 to 400 ft. per hour. Trenching time, above, includes lowering the pipe into the trench with the trench hoe boom. The description of the new backfill blade sounds pretty technical, so we suggest you write for further information to Schield Bantam Co., Waverly, Iowa, or use the coupon.

Use coupon on page 111; No. 10-10

"Stompactor" Tamps Backfill at Less Cost

Designed for tamping backfill earth within 3 ft. of large strucures, tamping backfill over trenches, and similar work, this machine will definitely cut tamping costs on large jobs. Power is furnished by a 25-hp engine; each tamping foot is 3 ins. wide and 13 ins. long, and operates at 30 to 150 blows per minute. Effective tamping is done at a rate of machine travel of 25 to 40 fpm. Later, smaller models will be available. Data from Lewis-Browning Mfg. Co., 111 Humble Ave., San Antonio 6, Texas, or by using the coupon.



For better compaction.

Use coupon on page 111; No. 10-11

Two New Truck Crane Models

Both of these units are truck-mounted, with rubber tires. The 1520T is the big brother, with a lifting capacity of 20 tons and a ¾-yd. capacity in excavator service. Air steering is standard on this. Power is either gasoline or diesel. Road speed is up to 30 mph. The 1014 is the little brother, with a lifting capacity of 10 tons and ½-yd. capacity as an excavator. This has a 35-ft. boom. Lots of other information is available for the technically minded,

Unit truck-mounted crane.

for which space is lacking here, so write Unit Crane & Shovel Corp., Milwaukee 14, Wisc., for it or use the coupon.

Use coupon on page 111; No. 10-12

Heavy-Duty Light-Weight Pipe

A new plastic pipe, with higher bursting pressure and resistance to highly corrosive water, wastes and gases is available. It is light in weight—a 100-ft. section of 2-inch pipe weighs 61 pounds; it can be curved to follow trench layout or structural plan. Internal and external sleeve-type couplings are available. It is furnished in sizes from 2-inch to 6-inch. The 6-inch, with a bursting pressure of 250 psi weighs 5 lbs. per foot. Information from Carlon Products Corp., 10127 Meech Ave., Cleveland 5, O., or by using the coupon.

Use coupon on page 111; No. 10-13

Front End Overhead Loading Tractor Shovel

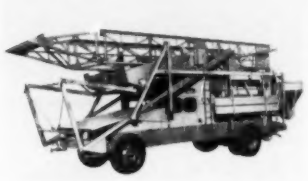
This 1-yd. overhead loading front end tractor shovel permits truck loading without turns, facilitating work in narrow quarters and increasing loading speed. Overhead

clearance is low. In addition to its use as a shovel, there are a number of useful attachments, including a hydraulic dozer blade mounted inside the tracks, a hydraulic angle blade, lift fork, rear mounted winch, crane boom with 5 tons capacity, snow bucket and snow plow. This unit is mounted on International tractors and is sold through International dealers. Information from Service Supply Corp., Philadelphia 32, Pa., or by using the coupon.

Use coupon on page 111; No. 10-14

Mobile Concrete Mixing & Elevating Plant

This looks like about the first streamlined concrete mixer we have noted. It has a capacity of 2 cu. yds., and has a standard 34-ft. steel tower, with 10-ft. extensions available. You move the unit in, raise the tower by power take-off, start the mixer, and place the concrete where you wish. It can also be used with ready-mix concrete. Folded for traveling, this unit is 33 ft. long and 12 ft. high; it weighs 24,000 pounds; it meets highway



Mixes and Elevates Concrete.

limitations anywhere. An experienced operator can set it up or take it down in 10 minutes. Want more information? Write Mixermobile Manufacturers, 8027 NE Killingsworth, Portland 20, Ore., or use the coupon.

Use coupon on page 111; No. 10-15

Writer-Editor Available

Man, 39, 4F draft status, two children, with broad writing experience in news, features, editorials and departments, both newspaper and magazine, and with clear and easy-to-read style, desires substantial permanent connection. Has civil engineering background; experienced in layout, photography and production detail. No objection to moving and some travel. Available immediately; references excellent. Just completing design of magazine for major heavy equipment and industrial firm. Write Editor, Public Works, attention ACM, who will forward all letters.

WORTH TELLING . . .

by Arthur K. Akers

To meet the growing demand for cement mortar pipe lining of both small and large water pipe throughout the country, the **Raymond Concrete Pile Company** and the **American Pipe and Construction Company** have organized a new company, **Pipe Linings Inc.**, with New York offices at 140 Cedar Street.

Pipe Linings Inc. will henceforth carry on the type of work in small pipe lining which has been done by the Tate Pipe Linings Co., of Andover, Mass., whose equipment and personnel they are acquiring.

Centriline Corporation, New York, **H. Seaver Jones**, president, and Centriline Division of American Pipe and Construction Company in the west will continue doing this work in larger diameter pipe.

•

Charles E. Smart has been elected president of **W. & L. E. Gurley**, 105-year old Troy, N. Y., manufacturers of engineering and surveying instruments.

Mr. Smart

Mr. Winter

Asphalt Institute, New York, announces appointment of **Walter F. Winters** as chief engineer. **Col. Bernard Gray**, serving as both president and chief engineer, relinquishes the latter post, to handle increased activities as president.

•

General Donald Armstrong, president of the **United States Pipe and Foundry Company,** announces that the company has purchased a 70-acre site in Decoto, Alameda county, Calif. on which will be built immediately the first plant on the Pacific Coast to produce centrifugally cast iron pipe. Completion is scheduled for the latter half of 1951.

•

Since 1920 more American lives have been lost on our highways than in all the wars of our nation's history. Physical improvement of our highway system is the only sure means of reversing this uptrend in traffic deaths. Such is the idea back of **Allis-Chalmers** tractor division's page advertisement in the Sept. 2 Saturday Evening Post. We commend this ad to you as though it were one of our own.

•

Alan J. Bronold is new sales manager for **Sterling Electric Motors Inc.**, in Los Angeles, vice Allen Adams, retired for reasons of health.

•

We got a gasp out of the sheer size of the new **Caterpillar Tractor Company** plant now under construction at Joliet, Ill. It adds 700,000 square feet of manufacturing capacity. Caterpillar has also announced the formation of Caterpillar Tractor Co. Ltd., wholly owned British subsidiary.

•

The M. B. Skinner Company, South Bend, Indiana, manufacturers of pipe repair clamps and saddles has just broken ground, too, for their new plant to increase production space by 50%.

•

Clinton Machine Company, of Clinton Mich., has just purchased a modern new factory in Maquoketa, Iowa, to triple its manufacturing capacity for Clinton engines.

•

Mr. Sperry

John R. Sperry has been appointed eastern sales manager of **Walker Process Equipment Company** of Aurora Ill., with offices at 30 Church St., New York.

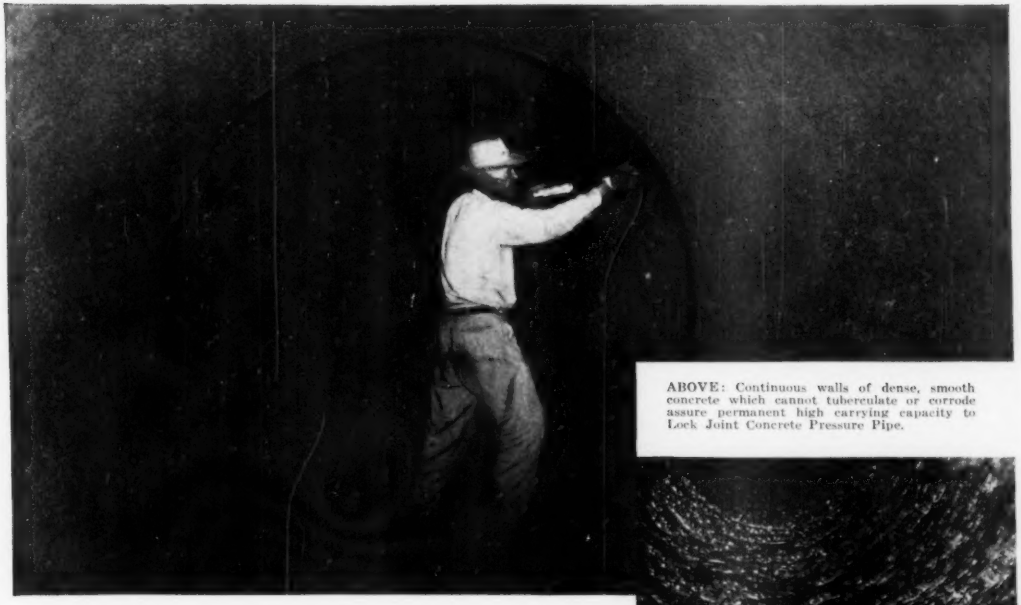
•

Toro Manufacturing Corporation, Minneapolis, has purchased the Coldwell-Philadelphia Lawn Mower business, as part of a continued expansion program in the manufacture of power mowers.

•

Burch Corporation, Crestline, Ohio, announces **E. R. Standfuss** has been elected president and general manager. **J. L. Morrow** remains active in the corporation as chairman of the board.

CONCRETE *is the answer to your main problem*



ABOVE: Continuous walls of dense, smooth concrete which cannot tuberculate or corrode assure permanent high carrying capacity to Lock Joint Concrete Pressure Pipe.

ABOVE: The tuberculated condition of this metallic pipe line reduces its carrying capacity by 50%.

Tuberculated mains—corroded mains—leaky mains—all cost municipalities, taxpayers and industry immense sums every year in added pumping costs, maintenance and repairs. Yet, by the use of Lock Joint Concrete Pressure Pipe, all of this unnecessary expense could be eliminated.

1. LOCK JOINT PRESSURE PIPE
does not tuberculate . . .

RESULT
- No excessive pumping costs
- No periodic cleaning costs
- No loss of income from inadequate delivery of water to the consumer

2. LOCK JOINT PRESSURE PIPE
does not pit or perforate from electrolysis or corrosion

RESULT
- No cost for major repairs
- No cost for periodic patchwork
- No loss of revenue while the line is shut down for emergency repairs.

Consider these facts when you plan your next water supply or transmission main and specify Lock Joint—the pressure pipe of perpetual economy.

Lock Joint Pipe Company for over forty years has specialized exclusively in the manufacture of reinforced concrete pipe for water supply and transmission mains as well as for sewers, culverts and subaqueous installations.

LOCK JOINT PIPE COMPANY

Est. 1905

P.O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich.

BRANCH OFFICES: Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. Kansas City, Mo. • Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. Wichita, Kan. • Kenilworth, N. J. • Hartford, Conn. • Tucumcari, N. Mex. Oklahoma City, Okla. • Tulsa, Okla.

HEADACHES